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ILLUSIONS OF THE SENSES.

BY RICHARD A. PROCTOR.

PROFESSOR LE CONTE of the California University has recently published in the *North American Review* an interesting paper on the Evidence of the Senses, in which he shows that on the one hand the senses often afford most incorrect information while on the other the powers of such scientific instruments as give exact information would be utterly unsuitable substitutes for our less exact senses. Sight tells us that an object is flat when it is round, touch that an object is double when it is single, hearing that sounds come from close by when they really reach us from a great distance; but on the other hand to have eyes with telescopic power, or fingers as sensitive as a chemist's balance, or ears with the sound-gathering qualities of the microphone, would unfit us for the kind of life we have to lead upon this work-a-day world of ours.

I propose now to discuss the question dealt with by Le Conte, with special reference to the liability of our senses to various forms of error. Taste and smell need not here occupy our attention. They are less used than the other senses in scientific research; and so far as the purposes to which they are chiefly directed are concerned they are in the main trustworthy. They may deceive us by presenting as pleasant what is really deleterious, but once experience has determined the qualities and effects of substances having such and such taste or odour, we are not often deceived in identifying those substances thereafter.

The sense of touch is commonly understood as including the sense of heat-effects. But here, as Reid long since pointed out, our division of the senses is unsound. Undoubtedly the sense of touch is entirely distinct from the sense of heat,—though we may be said to *feel* in both cases. The error probably arose from the circumstance that the same organs seem employed in noting the effects of contact and the effects of heat. I touch a surface to see if it is hard or soft, rough or smooth, just as I touch a surface to see if it is hot or cold: moreover there is no part of the body which is sensible to the effects of contact which is not also sensible to the effects of heat and cold. But we recognise a marked difference between the sense of touch when the tip of the tongue is employed for the moment as the organ of touch, and the sense of taste; yet the difference between taste and touch is not more marked than the difference between heat and touch.

Therefore in dealing with errors affecting the evidence given by the sense of touch, I consider only those really relating to the effects of contact, dealing separately with those relating to the effects of heat and cold.

Aristotle long since pointed out how the sense of touch may be deceived when the organs of touch are employed in some unaccustomed manner. It was he who first mentioned, if he did not invent, the experiment of rolling a pea between the tips of the first and second fingers, after the second finger has been crossed over the first. This experiment is instructive as showing how much of the significance of the teachings of our senses may be due to the effect of long-continued training. Every time we touch with the finger-tips an object of known shape, we are in reality teaching our fingers that such and such impressions have such and such a meaning. When two fingers are crossed, the finger-tips receive different impressions from those which they receive in their normal position, and we naturally misinterpret the meaning of the impressions so received. Thus if I touch with my first and second fingers the sides of a space shaped thus ◡, the outsides of the fingers come in contact with the curved surface, whereas the insides of the fingers feel such a surface as this,—◠: so soon as the fingers are crossed these effects are reversed; the outsides of the fingers are brought together by the crossing and touch a surface shaped thus ◠, telling us apparently that it is really a surface shaped thus ◡ that we are touching. To test this apply the crossed fingers to a surface shaped ◠◠, so that the fingers touch the convex curves near their place of meeting: now we find that we no longer seem to be touching two curves, but one. It must be admitted, however, that this experiment is less striking than the other; the information conveyed by the finger-tips instead of seeming definitely and decidedly incorrect, appears but vaguely erroneous.

Let us try a few other experiments with crossed fingers. Take a penholder or pencil, and with first and second fingers crossed slide the finger-tips along the pencil or holder. If the eyes are closed the fingers seem to tell us emphatically that we are feeling two parallel rods. Yet if the eyes are directed to the finger-tips the illusion disappears. This is not, however, because the eyes assure us that there is but one pen or pencil; it is because the eyes show us that the fingers are crossed. To show that mere knowledge will not save us from the illusion, feel with the crossed fingers the tip of the nose. We know certainly that we have but a single nose-tip; yet the absurd and illusory feeling that we have two noses is immediately produced. The illusion is strengthened if the crossed finger-tips are caused to slide along the ridge of the nose. Very curious illusions are produced if the crossed finger-tips are carried along either lip, or between the lips, or along the bone ridge below either eye or along the ridge above the eye, or round the ear, and so forth. But in my own case, the oddest illusion of all is obtained by crossing the forefinger behind the little finger, (both being bent somewhat towards the palm, so that the second or third fingers are behind them) and then feeling with these crossed fingers the

tip of the nose: for now, not only does the nose appear double, but *one nose appears to be longer than the other.* One can easily understand why this is. Under ordinary conditions the first and little fingers cannot at the same moment feel two bodies which are equidistant from the observer,—or let us say from the palm. If for instance we place the forefinger tip on the end of a white note on the piano, the little finger tip can only rest on the end of another white note by bending the hand: we can however touch an end of a black note with the forefinger tip while the third finger tip touches the end of a black note, without bending the hand. The lesson taught, then, by constant experience (unnoticed through its very familiarity) is that two bodies so felt extend to different distances. But in the experiment with crossed forefinger and little finger, the finger-tips touch at the same moment the same nose-tip: which appears double because touched by the outside edges of the fingers, and the two noses appear of unequal length because it seems as though the little finger touched one while the forefinger touches the other, each of them at the tip.

Other singular effects may be produced by crossing the fingers, varying the combinations. If the forefinger and second finger of the left hand be crossed as well as those of the right, and a small object be held between the crossed pair of each hand, the most incorrect ideas of the shape of the object are given. I have just tried the experiment for instance on a small box of pen-nibs, holding two opposite corners, one between the crossed finger-tips of the right hand the other between those of the left hand; it was impossible to realise that the object thus held had any regularity of shape at all.

Another experiment on the sense of touch depends on the circumstance that usually the outsides of the hands are so placed that if both touch two surfaces at the same time those surfaces are not in the same direction. Of course the two hands can be placed side by side with their backs uppermost and a flat surface may so touch both; but usually the palms are towards each other, and this is especially the case when both hands are used in holding anything. Place the hands together palm to palm, then cross the arms so that the hands are back to back; if now a book is held between the backs of the hands its edge appears bent. The force of this illusion is different with different persons; but let not those who are not affected by it rejoice as being less easily deceived than their fellows; for, as Sir David Brewster remarks in speaking of an illusion affecting sight, it often happens that the most observant are those most completely deceived by such illusions.

There is another curious illusion of touch which appears to depend on the teaching which the hands and arms have had (unconsciously) in estimating the dimensions of bodies held in the normal way, in front of the body. Suppose a book lying on a table before you, the back of the book being towards the right. Take hold of it by the nearest right-hand corner (that is, holding it by the end of the back nearest to you) and pass it over the right shoulder so that the face which had been uppermost lies against the back of the right shoulder in a nearly vertical position. Now pass the left hand round behind you under the left shoulder-blade till you can grasp with it the edges of the leaves. You will now find that though you *know* from the feel of the edges that your left hand holds a side several inches from the back held by the right hand, that side of the book appears to be a continuation of the back of the book,—so far as direction is concerned. The explanation appears to be simply this:—When an object like a book is held in front of the chest, the right hand holding one side, the left hand reaches the opposite side without effort or stretching; while with a slight amount of stretching the side held by the right hand can be reached: now when the book is held behind the back in the way described above, an effort is required to reach with the left hand the side opposite that held by the right, hence the same effect is produced on the mind as when in the normal way of holding objects of the kind the left hand is stretched over to the right hand's side of the object; thus instead of the left hand touching the side opposite that held by the right, it appears to touch the same side.

So much for illusions affecting touch. Or rather, these afford sufficient evidence that the sense of touch may be readily deceived. But in reality, scarcely a day passes without our noticing, if we are at all observant, illusions affecting this sense. If we observe the circumstances under which such illusions occur we generally find that they arise when some organ of touch is used in a novel or unusual way. But in the majority of cases arising in ordinary life the sense of touch acts in combination with either the sense of sight or the sense of hearing, and consequently the illusions arising are not such simple examples of errors in the evidence afforded by the sense of touch as those considered above.

(*To be continued.*)

LIFE IN DEATH.

By William Curran.

(*Continued from p. 26.*)

Let us now turn to another phase of the question, and see how far that deviates from credibility, or accords with the experience of our common life. Dwelling, apparently with much complacency, on what he calls the *Horrendus Maximini interritus—alias* the painful death of the tyrant Maximinus—Lactantius says (*De Mortibus Persecutorum*):—"*Deinde post multos gravesque cruciatus, cum caput suum parietibus infligeret, exilierunt oculi ejus de caveis*"; and it is worth while asking whether any one, sane or otherwise, can *per se* "dash out his own brains," or cause his own eyes to start or jump out of their sockets. Grave writers and "able editors," as Carlyle would call them, say the thing is possible, and we occasionally read of such performances in connection with police-cells, lunatic asylums, and the like. Thus the reverend author of a little book called "A Popular History of the Insurrection of 1798," after mentioning the dreadful sufferings that were endured by those who were subjected to the horrors of half-hanging and the pitch-cap in that year, says, p. 72, that the victims of these pleasantries "dashed their brains out, in the madness of intolerable pain, against some neighbouring wall, and thus put an end at once to their life and misery"; and the following occurs in Mr. O'Hagan's translation of the Song of Rowland":—

> He (R.) saw the Saracen seize his sword,
> His eyes he ope'd and he spoke one word—
> * * * * *
> On the golden crest he smote him full,
> Shattering steel and bone and skull;
> *Forth from his head his eyes he beat,*
> And cast him lifeless before his feet,*

where we may safely leave him for the present.

* Somewhat akin to this is the crime or occurrence mentioned in

If now, making every allowance for the poetic licence assumed above, as well as for the strange juxtaposition of bone and skull, as if they were not here as elsewhere identical, we come to the beating out of the eyes and the dashing out of the brains, and ask ourselves if such things ever can or ever do happen, our answer will be that they probably never do. And yet stranger occurrences than even these have been gravely recorded by eminent historians. As an instance in point, we will quote the following from Milman. Mentioning the hard usage according to which the Syndic of the Jews was obliged to salute the Mayor of Toulouse about the year 980, he says (*ut supra*, vol. ii., p. 146) that: "A stern, iron-handed magistrate struck the poor Syndic with such force as to scatter the brains of the unfortunate unbeliever"—and the hand that achieved this feat must, indeed, have been made of iron or other equally potent material; for unless this wretched Syndic was suffering from that very rare condition called *Mollities ossium*, or that our magistrate had the strength of a Hercules, it is hard to conceive how such a result could follow from such a cause. And yet there is no affectation of poetic licence or unreality here—the possibility of the thing is taken for granted, and there is no such qualification as even a query or a note of admiration could supply. All we need, therefore, say in this connection here, is that where grave and learned writers like Milman put forward such statements without question, we ought not to be surprised when we find Scott and other romancists of his class investing their heroes with such attributes as are clearly beyond the reach of ordinary mortals.

It is, we believe, generally admitted that negroes have sometimes succeeded in committing suicide by swallowing their tongues; in other words, by doubling them back, and then drawing them into their throat, so as to stop the access of air to the lungs;* and excision of the tongue is now a recognised surgical operation. But this operation to be successful or effective must be performed by a skilled surgeon or a trained executioner, and persons desirous of shuffling off the mortal coil never dream of trying to do so through the medium of this organ. We have it, however, on the authority of Major Macpherson ("Memorials of Service in India," p. 67) that, "a Khond, captured by our troops in Baramootah, immediately tore out his tongue by the roots and died," probably of the hæmorrhage which such an attempt would necessarily entail. But it does not seem possible for any one to tear out his own tongue with his own unaided hands, and in proof of this we have only to ask our readers to try and seize that somewhat slippery muscle themselves. If they will try they will probably find that they cannot introduce the hand into the mouth without producing sensations that would prove fatal to such an attempt; and, even supposing that they had so far succeeded, how are they to drag—for that's the assumption—this very elastic piece of mechanism from its strong and deep-rooted attachments? The thing seems to be impossible, and we need not fear that our allusion to it will induce any future *felo-de-se* to prefer it to the easier and speedier alternatives of a jump over London-bridge or a resort to the ever-ready razor.

But we must hurry on to a close, and with this view restrict ourselves to one or more illustrative extracts of the character here contemplated. Describing the decisive battle that took place between the forces of Mahomed Shah Adily and those of the famous Akbur, Major Briggs says "Rise of the Mahomedan Power in India," that the former's Commander-in-Chief, one Hemoo, was pierced in the eye with an arrow, which penetrated the brain; "he sunk into his howda from extreme agony, and the greater part of his troops, fearing that his wound was mortal, left him. Raising himself again, Hemoo drew the arrow from his head, and with it the eye from its socket, which he wrapt up in his handkerchief. He continued to fight with unabated vigour until he contrived, with the few men who remained faithful to him, to force his way through the enemy's line." That a brave man should continue to fight for dear life after he had lost an eye, in battle or otherwise, is no very uncommon or extraordinary thing; but that he should do so under the circumstances here disclosed is certainly unusual, and if such wounds as are casually inflicted in this region by the poke of an umbrella-handle or the thrust of a walking-stick prove, as we believe they always do, fatal, we may well doubt the practicability of the feat narrated above.

A writer in the "Philosophical Transactions" (A New Abridgment, vol. iv., pp. 106-7) gives such an account of the effects of a cancer on the brain of a certain person as, if verifiable, would go far to show that Shakespeare's belief, "the man is dead when the brains are out," admits of some qualification. This account may, for brevity's sake, be summarised as follows:—A certain man "had a cancer which spread itself, in spite of the endeavours of the most eminent surgeons of the day, over all the cheek, into his mouth, and across the upper part of his nose, where it perforated the bone and ate away all the flesh round his eye, so that he could take out the latter with his own hands," and we suppose, though this is not actually said, put it into his pocket. It finally exposed the dura mater, and with it the brain itself to view, several portions of which came away. "And what was most extraordinary was that he perfectly retained his senses, and rose every day to dress the ulcer himself till a considerable quantity of the brain had come away." When he died, four days after taking to his bed for the last time, "his brain *was totally consumed*, and nothing remained in the cranium but a small quantity of black putrid matter," and we are gravely asked by this philosophical writer to believe this.

Were we to do so, we would be simply flying in the teeth of all experience, and reducing the researches and the observations of our best scientists to a level with the wild exaggerations of Mr. Holloway or St. John Long. This we decline to do, and if a man may go about his ordinary business without any

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the following lines from the old song, "The Clerks of Owsenford," see Roberts' Legendary Ballads:—

"Then he has ta'en the twa bonny clerks,
Bound them frae tap to tae,
Till the reddest blude in a' their veins
Out oure their nails did gae."

The following story from Gilbert's "History of the Viceroys of Ireland," page 63, would, if true, seem to justify the accounts given by Scott and others of their fabled heroes. Describing a feud that existed between Hugues de Lasci, "John's representative, and a powerful baron named De Curci," our author says that the latter was attacked by the former while at prayers in the cathedral of Down, with the following result: "With the pole of a cross snatched from the head of a grave in the churchyard, De Curci slew thirteen of De Lasci's soldiers ere he was overpowered and sent in fetters to the Tower of London."—*Credat Judæus Apella, non ego!*

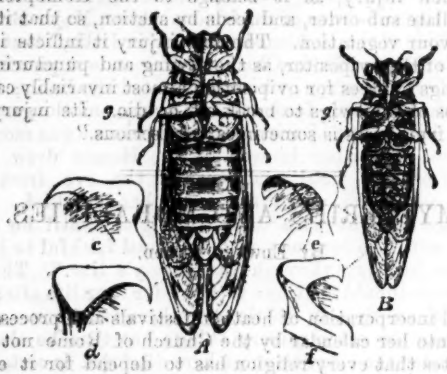
* Woodman and Tidy's "Handybook of Forensic Medicine," p. 956. The following is, perhaps, the most extraordinary case of suicide on record. It is gravely related by Mr. Talboys Wheeler in his able "History of India," Vol. I. p. 323, and runs to the effect that, "Drona, one of the heroes of the Mahábhárata, believing that his son was dead, drew up all the breath of his body into a spot in the neighbourhood of his heart and drove it into his head, upon which the top of his skull was burst open, and his soul escaped through the orifice like a ray of the sun."

brains, there is no good reason why he may not do the same without his head, or why, in a word, the "miracle" of St. Denis may not be reproduced, *puris in naturalibus*, any day, at the Egyptian Hall or elsewhere, in our very midst.

SEVENTEEN-YEAR CICADA.*

By C. V. Riley.

Of all the numerous insect tribes no one species is more peculiarly North American, or attracts more curiosity, than the periodical cicada, otherwise known as the "seventeen-year locust" (*Cicada septemdecim*, L.). It will be particularly noticeable the present year, because there is to be, according to the chronology published, the conjunction of two extensive broods.



Seventeen-year Cicada (*Cicada septemdecim*, Linn). A, ♂ of typical form; *c*, *d*, genital hooks; *g*, singing apparatus. B, ♂ of the small form (*cassinii*); *e*, *f*, genital hooks. Colours: (*A*) black, orange and orange-brown; (*B*) black and orange.

There is a voluminous literature on this insect, and a very full account of it was given by the present writer in his "First Report on the Insects of Missouri," just seventeen years ago. In that article it is made evident that, besides a number of broods requiring seventeen years for their underground development, there are others belonging to a thirteen-year race or variety, which he called *Cicada tredecim*.

From the chronological record there given, the brood XXII., which is a seventeen-year brood, and which last appeared in 1868, will appear this summer on Long Island; at Brooklyn, in King's County, and at Rochester, in Monroe County, New York; at Fall River, and in the south-eastern portion of Massachusetts; at Rutland, Vermont; in Pennsylvania, Maryland, District of Columbia, Delaware, and Virginia; in north-western Ohio, in south-eastern Michigan, in Indiana, and Kentucky.

This brood has been well recorded in the East in 1715, 1732, 1749, 1766, 1783, 1800, 1817, 1834, 1851, and 1868.

The other brood (brood VII.), which is a thirteen-year brood, appeared last in 1872, and will occur in the southern portion of Illinois, in Kansas, Missouri, Georgia, Louisiana, Tennessee, and Mississippi.

It will thus be seen that the cicada is to occur over an extended area, the seventeen-year brood covering a wedge-shaped track of country, having its widest border near its northern limit, and thence gradually narrowing toward the south, with its southern point reaching northern Georgia. The thirteen-year brood is located to the south-west of this wedge, and is much more limited in extent. The relative areas of the two broods are indicated in the accompanying map. This gives only the localities which have been fully verified, though there are doubtless many other connecting points between the separated regions.

Note.—The visitations of the seventeen-year brood are indicated by dots; of the thirteen-year brood by lines.

The two broods would seem nowhere to overlap and come in contact with each other, as they are separated by the whole extent of northern and central Illinois, and nearly the whole State of Kentucky. They approach each other most in Georgia.

The periodicity in the appearance of this insect is so constant that the naturalist calculates as confidently on its future recurrence in a given month of a given year, for all future time, as the astronomer does on an eclipse or a transit on some particular day. There is something rather pleasant in the feeling that we may go back in mind to some particular day of a particular year in the past history of our continent, long before civilised man had discovered it, and feel perfect confidence that the woods rattled with the hoarse cry of this cicada in the month of June, very much as they are now doing.

The habits of this insect are briefly given by me in the "Western Farmers' Almanack" for 1878, from which I quote:—

"The appellation of 'locust' was bestowed upon it by the early settlers of this country from an erroneous notion that it was identical with one of the 'plagues of Egypt' recorded in Biblical lore. This idea took such forcible possession of the Puritanic mind that the shrilling of these insects was thought to be a prolonged and threatening cry of 'Pha-a-a-raoh!' Its habits being entirely unknown in those early times, its sudden appearance in prodigious numbers at such long intervals naturally caused it to be regarded as a supernatural visitant sent for the twofold purpose of a plague and a warning. Hence the popular superstition construing the two W-like markings on the tips of the upper wings into a prophecy of 'war.' Timid people may rest assured that they portend nothing, unless it be warm weather. The peculiar musical apparatus of the males may be likened to a pair of kettle-drums. These drums are formed of convex plates of parchment-like substance, folded into fine plaits and located in cavities behind the thorax. Muscles are attached internally to these plates, by the contraction and relaxation of which the drum-heads are alternately tightened and loosened, the effect being a

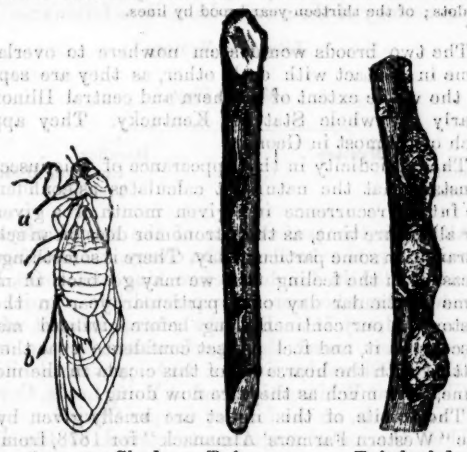
* From *Harper's Weekly*.

rapid succession of shrill, rattling sounds. The males only possess these musical organs, the females being absolutely mute—a fact which was embodied in the lines of Xenarchus,

> Happy the cicada lives,
> Since they all have voiceless wives.

"The body of the female is provided with a complicated piercer and ovipositor, consisting of a pair of tiny double-edged saws and a spear-pointed borer, which plays between them. When not in use, this instrument is folded into a longitudinal groove on the under surface of the abdomen. Both sexes have a sharp beak, or *haustellum*, with which they pierce the bark of shrubs and trees, and extract the small quantity of sap which constitutes their sole nourishment.

"The periodical cicada emerges from the ground and attains its wings during the latter part of May or early in June, in the latitude of the Middle States, the males usually appearing several days in advance of the females, and perishing proportionally early. Immediately after pairing, the females begin the laborious process of oviposition, the result of which is the severe, and sometimes fatal, summer pruning of our forest and fruit trees. With her ovipositor the female penetrates the twigs of trees, and inserts therein two rows of eggs obliquely



Seventeen-year Cicada (*Cicada Septemdecim*, Linn.), side view of ♀ to show beak, *a*, and ovipositor, *b*. Colours.—Black, brown, and orange.

Twig punctured by the Seventeen-year Cicada.

Twig healed after the puncture.

placed. The eggs are one-twelfth of an inch in length, of a pearl-white colour, and taper at each end to an obtuse point. They hatch in about six weeks, usually before the branch containing them breaks off. The newly-hatched cicada is very active, its motions resembling those of an ant. It soon casts itself fearlessly from the highest tree-tops, its insignificant weight admitting of its being wafted gently downward to the ground. Impelled by instinct, it at once burrows underground in search of rootlets, upon whose exudations and sap it subsists, penetrating deeper and deeper into the earth in following their course. It has many times been found at a depth of from 10 to 12 ft.

"This cicada has many enemies, but none more striking than the large hornet or digger-wasp (*Stizus grandis*), the female of which stings, paralyses, and buries it in a burrow beneath the ground as a future store of food for the young wasp.

"There are always reports, during the prevalence of this cicada, of its stinging people; but the researches of entomologists have shown pretty conclusively that all reports of such stinging are based on misapprehension, and are more likely caused by the hornet in question, which, knocking against a person when flying with her heavy burden, will naturally resent the impediment by using her sting.

"The popular appellation of 'locust,' applied to this cicada, has given rise to a good deal of confusion, and serves to confound it in the popular mind with the destructive locusts, or so-called grasshoppers, which ravage our crops. These belong to the Orthoptera, an order of mandibulate insects. Reports of serious injury by these ravenous pests, which belong to the same family as the locusts of Scripture, already come from the south-east and from California. But the cicada is incapable of any such injury, as it belongs to the Homoptera, a haustellate sub-order, and feeds by suction, so that it can not devour vegetation. The only injury it inflicts is by means of the ovipositor, as the sawing and puncturing of the twigs of trees for oviposition almost invariably causes the tips of the twigs to break off or die. Its injury on young fruit-trees is sometimes very serious."

MYSTERIES AND MORALITIES.

By Edward Clodd.

II.

THE incorporation of heathen festivals and processions into her calendar by the Church of Rome not only indicates that every religion has to depend for it existence upon like agencies, but also that what was thought to be distinctive to one religion is found to be common to all, the difference being always in degree and detail, never in substance. "There is nothing hardly," says the author of the 'Essay to Retrieve the Ancient Celtic,' "that will bear a clearer demonstration than that the primitive Christians, by way of conciliating the Pagans to a better worship, humoured their prejudices by yielding to a conformity of manners, and even of customs, where they did not essentially interfere with the fundamentals of the Gospel doctrine. This was done in order to quiet their possession and to secure their tenure: an admirable expedient, and extremely fit in those barbarous times to prevent the people from returning to their old religion."*

Subsequent inquiry endorses this statement in the main, identifying some of the principal Christian festivals with their pagan prototypes, as, *e.g.*, Christmas Day with the day of the winter solstice in the Roman calendar, and of the celebration of the birth of the sun-god Mithra, an imported Vedic deity; Easter Day with the worship of the Teutonic nature-god Eastre;† and May Day, also the *festa* of the Virgin, with the Floralia of the Romans, but stripped of their licentious merriment. The venerable Bæda, in his "Ecclesiastical History of England," cites a letter from Gregory the Great in the sixth century to the Abbot Mellitus, then on his way to this island, in which he bids him tell Augustine, the first Archbishop of Canterbury, that the temples in Britain should not be destroyed, but sprinkled with

* Quoted in Brand's *Pop. Ant.* I., 136.

† Ostara, or Eastre, seems to have been the divinity of the dawn, and perhaps of the spring, and the festival in her honour "could," as Grimm says, "be easily adapted to the festival of the Resurrection."—T. M., pp. 290–1.

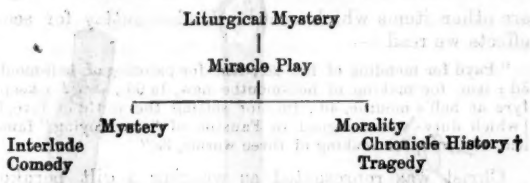
holy water, and relics placed in them, the idols being shattered. Also that the sacrifices should be continued, only the objects offered being changed, and that permission be given to build huts of boughs about the transformed temples on the day of the dedication or of the birth of the martyrs whose relics are deposited therein. Concerning the more popular entertainments with which the Church humoured the multitude, as before her the Empire had appeased the hunger of the Romans for "*panem et circenses*,"—"bread and games", we find, prior to the acting of Miracle Plays and Mysteries in thoroughfares, and as surviving among them here and there long after their introduction, frequent reference to mock festivals and grotesque processions, probably of Saturnalian origin, as, among others, the Feast of Fools, the Feast of Asses, and the Boy-Bishop. At the Feast of Fools a sham pope was elected, amidst gross and wanton burlesque of the pontifical office. The priests forming his suite dressed themselves as players in a pantomime, blackened their faces, sang lewd songs, danced with indecent gestures round the altar, on which they played with dice and burned old shoes for incense. At the Feast of the Ass, said to be instituted in honour of Balaam's reproving ass, but really a variant of the Feast of Fools, and more often commemorating the flight of the Holy Family into Egypt, the fairest maiden and prettiest infant in the place where the feast was held were mounted on an ass, and led at the head of a gay procession to the church, where service was performed, the several parts of which were ended with the imitation of a donkey's braying, instead of with the *Gloria Patri*, &c.; and at the conclusion, as the ass was led to the choir, a hymn of nine stanzas sung, of which the following is a specimen verse:—

(*Free translation.*)

Orientus partibus	From the regions of the East—
Adventavit Asinus	Blessings on the bonny beast!—
Pulcher et fortissimus	Came the Donkey, stout and strong,
Sarcinis aptissimus	With our packs to pace along,
Hé, Sire Ane, hé.	*Bray, Sir Donkey, Bray!*

As at the Saturnalia of the ancients, when distinctions were for the time being effaced, and masters and slaves changed places, the church menials were wont at the Feast of the Innocents to perform the priestly offices in extravagant parody. The same day witnessed the end of the authority of the Boy Bishop, elected on the anniversary of St. Nicholas, patron saint of children, by the choir-boys of cathedrals, which were given up to this mock episcopal sovereignty.

But enough has been cited respecting this class of amusement to illustrate the flexible adaptability of the Church to human nature; her utilisation of that which she could not abolish, or which, repressed, would only have broken loose in more extravagant form, and in rebellion against her authority. Such illustrations, however, are of value in disclosing the ecclesiastical framework and colouring of all popular recreations, as well as of the more serious dramatic presentment which to a large extent supplanted them. In connection with this some reference should be made to an interesting argument adduced by Klein, Ward, and others, that "the germ of the miracle-play as an acted drama is to be found in the liturgy of the Mass, the symbolic processes in which exhibit a dramatic progression."* Without doubt, as the calendar was more amplified, the services of the Church, and especially those connected with such important seasons as Christmas and Easter, became more dramatic in character. In the Liturgy of the Mass in the pantomimical element in the gestures of the priest, the epical in the lessons read, the lyrical in the antiphonal singing, and subsequently in the additions as early as the fifth century of *tableaux vivants*, living pictures of scenes from New Testament history, the way was made ready for the public performance of sacred plays by clerical actors. The date of the connection of the epical portion of the liturgy with the spectacular and lyrical is uncertain; but a writer of the tenth century says:—"It was customary on Christmas-day, after the *Te Deum*, to perform the office of the Shepherds, others of the same kind, such as that of the Innocents of Bethlehem, the Star, the Sepulchre, being celebrated each in its season."* Thus these offices were a visible repetition of the gospel of the day, in which, as a matter of course, priests were the actors and the church the scene. Remembering how entirely the Church usurped to herself the functions of instructress of the masses, how, indeed, but for her they would have remained ignorant, and how similar are the instruments of the ritualist and the actor, there is great force in the argument of the writers alluded to, that the Miracle-play as a spectacle is the lineal descendant of the liturgical mystery, the didactic element being, as shown already, the survival of the ancient metrical paraphrases of scripture. Hence the genealogy of the secular drama is as follows:—



Although the performance of the sacred plays long remained in the hands of the clergy, we find them frequently acted in London, before king and court, by the parish clerks, who were incorporated into a guild in the reign of Henry III. But the central interest of these plays gathers round their performance by the trading guilds or fellowships in the large provincial cities, as at Chester at Whitsuntide, and at York, Leeds, Coventry, and Newcastle, on the feast of Corpus Christi.

This, the most magnificent festival of the Roman Catholic Church, was instituted in 1264 by Urban I. in honour of the consecrated Host, and the high importance accorded to it led the guilds to regard it as a common feast day, and to select it for the exhibition by each company of its own appropriate play in the series of Mysteries, which began with the Creation and ended with Doomsday. The plays were originally the work of monkish pens, but lay writers were employed here and there in the alteration and adaptation of them to the requirements of the trading fraternities, who entrusted both plays and properties, choice of actors, "good players, well arayed, and openly spekyng," as well as the rehearsals, to an official. The actors were paid according to the length of their parts and quantity of business in them, not according to their dignity. Thus, in a play setting forth the trial and crucifixion of Jesus, the impersonators of Herod and Caiaphas received 3s. 4d. each; of Annas, 2s. 2d.; and of Jesus, 2s., which was also the sum paid to each actor in the parts of his executioners. The Devil

* Cf. Prof. Ward's valuable "Eng. Dramatic Lit.," Vol. I. pp. 19-22.

* Quoted in Ward, Vol. I., p. 21.

† Concrete examples from history taking the place of impersonated ideas.

and Judas were paid less, as these extracts from the pageant accounts show :—

Payd to the players for rehearsal—Imprimis, to God, 2s. 8d.; itm. to Pilate his wife, 2s.; itm. to the Devil and Judas, 1s. 6d.

Peter was paid 16d.; the two damsels, 12d.; while one Fauston, for the commendable duty of hanging Judas, receives but 5d.; and, ubiquitous genius as he seems to have been, "for coccroying, iiijd."*

The clerical vestments had been originally borrowed or hired from the churches for the use of the actors of sacerdotal characters like Caiaphas and Annas, a practice which was censured by the stricter clergy (notably by the Bishop of Winchester in 1384, as sacrilege), who at last refused to lend their vestments for that purpose, so that the guilds were obliged to provide the costumes and other properties at much outlay. "To all the city," says an old proclamation, "follows labour and cost." In Sharp's "Dissertation on the Coventry Mysteries" (1825), from which the foregoing extracts from the registers of the trading companies are quoted, we find the following items of cost of repair and wardrobe :—

"For mending of Dame Procula's garments, 7d." [Dame Procula was Pilate's wife]. "To reward to Mrs. Grimsby for lending of her gear for Pilate's wife, 12d." "For a quart of wine for hiring Procula's gown, 2d." "Payd for a pair of gloves for God [all the characters wore gloves]; for gilding God's coat." "Dyvers necessaries for the trimmynge of the Father of Heaven,"

are other items which occur. Under outlay for scenic effects we read :—

"Payd for mending of hell 2d; itm. for painting of hell-mouthe, 3d; itm. for making of hell-mouthe new, 1s 9d; itm. for keeping fyre at hell's mouthe, 4d; itm. for setting the world of fyre, 5d; [which duty was assigned to Fauston of "coc-croying" fame]; itm. to Crowe for making of three worlds, 2s."

Christ was represented as wearing a gilt peruke or beard, and a painted sheep-skin coat, a girdle, and red sandals. His tormentors wore black buckram jackets with nails and dice upon them. The Virgin Mary wore a crown; the angels had white surplices and wings, the souls of the saved wore white coats, and the souls of the lost wore coats of yellow, black, and red, which last colour was given to the hair of Judas Iscariot and the beard of the devil. The faces of all the actors were either painted or covered with masks. Herod wore a gilt and silvered helmet, and was dressed like a Saracen, not an unusual anachronism, as we shall see presently—not more so, at least, than the rosary round the neck of the Virgin, or the pictures of the Prodigal Son, in which that first century "masher" is represented in eighteenth century costume, attended by a negro servant carrying his trunk. The devil had wings and a leather dress, trimmed with feathers and hair, and ending with representations of claws for the hands and feet. That extra pains were bestowed upon the head-gear is shown in the entry of payment to "Wattis for dressing the devil's head." The intended exhibition was announced by proclamation or *bane* (a word retained in our marriage *bans*), made by three heralds (*vexillatores*) with sound of trumpet and lengthy prologue ending to this effect, as in the Coventry series :—

A Sunday next, yf that we may,
At vj of the belle we gynne oure play,
In N.towne,† wherefore we pray
That God may be youre spede. Amen.

Archdeacon Rogers, who saw the plays acted at Chester in 1594 according to old usages, thus succinctly describes the mode of exhibition :—

The manner of these playes were, every company had his pagiant, which pagiants weare a high scafold with two roumes, a higher and a lower, upon four wheels. In the lower they apparelled themselves, and in the higher roume they played, beinge all open on the tope, that all behoulders might heare and see them. The places where they played them was in every streete. They began first at the Abay gates, and when the first pagiant was played it was wheeled to the highe crosse before the Mayor, and soe to every streete, and soe every streete had a pagiant playing before them at one time, till all the pagiantes for the day appointed weare playen, and when one pagiant was neere ended, worde was broughte from streete to streete, that soe they might come in place thereof, exceedinge orderlye, and all the streetes have their pagiantes afore them all at one time playeinge together; to see w'ch playes was greate resorte, and also scafoldes and stages made in the streetes in those places where they determined to playe theire pagiantes.

The term *pageant*, it may be remarked, is derived from the movable vehicle on which the plays were performed.

* "*Et cantabit gallus.* And than Jhesus xal (shall) lokyn on Petyr, and Petyr xal wepyn, and than he xal gon out and seyn," &c.—"The Trial of Christ," *Coventry Mysteries*, 297.

† The letter N represents a space to be filled in with the name of the town where the performance was to take place.

THE RUDDY ECLIPSE OF THE MOON.

BY RICHARD A. PROCTOR.

I AM sorry that I misunderstood Mr. Mattieu Williams's red-hot moon theory. I cannot even now see that there is much more "monstrous absurdity" in the idea of primeval heat making the moon red-hot than in the idea of solar heat warming up the moon to redness. Has Mr. Williams ever tried the experiment of heating a tufaceous surface to redness? It strikes me that if he had he would hardly imagine that the action of the solar rays could produce such a result, even without the exceedingly rapid radiation which he admits would go on all the time.

However, it appears that it is not primeval heat, as I feared, which he attributes to Dian's cold pale orb. So we are at least in agreement on one point. I am also in tolerable agreement with him about the absurdity of being "so cocksure" as some are, *to-day*, about the nebular hypothesis. (By the way, a correspondent seemed to doubt, a short time since, in the columns of KNOWLEDGE, that Shakespeare had used the term "cocksure." I thought every one had read the scene between Gadshill and the Chamberlain, at Rochester, where Gadshill says, "We steal in a castle, cocksure.") Surely, as Mr. Williams points out, knowledge has fairly defined limits; beyond these is the region of speculative folly." But why call this "the blessed abode of transcendental mathematicians"? Surely there have been other originators of speculative folly than mathematicians of the transcendental type. The twenty paradoxists whom *I* should select as the wildest I know of, are not (or were not—for some are dead) mathematicians at all. I doubt even if nineteen-twentieths of my friend's "Fuel of the Sun" must not be regarded as outside the fairly-defined limits of the field of knowledge. Or rather I am not doubtful on the subject at all. As to the theory of young, middle-aged, and senile worlds, though it is one which I rather like, because it is based on reasoning and on certain known physical laws in regard to radiation and conduction (laws which Mr. Williams ignores in opposing that theory) I am not so enamoured of it but that I always present it as serving chiefly the purpose of a thread, on which astronomical facts,—including by the way every *fact* presented in Mr. Williams's "Fuel of the Sun"—may be conveniently strung. That those facts

do run so readily on the thread of theory seems to show that I have got hold of a sound and well-spun thread. But I care much more for the beads of fact than for the thread of theory.

But now, with regard to actual facts. That ruddy colour in our skies,—should it have led us to expect a ruddy moon or not, according to the accepted explanation of the origin of the ruddy light? (Mr. Williams speaks of *my* theory; but I have never advanced a theory of my own about a matter already thoroughly well explained by others. There is indeed no *theory* about the ruddy eclipsed moon, any more than there is about 2 and 2 making 4.) Mr. Williams, when he supposed that the accepted explanation ascribed the moon's red light to the illumination of our air by the sun's rays, was quite right in inferring that the eclipsed moon ought to have been very red on Oct. 4, and on March 30. But now that I have shown how the accepted explanation really accounts for the moon's ruddiness in total eclipse, he no longer is justified in saying that the moon should have looked red on those occasions. For, every one who has given the least attention to the observed phenomena of the coloured sunsets, knows that let their cause have been what it may (the Krakatoa explosion is unquestionably exploded) the ruddy light was not due to transmitted but to reflected and dispersed rays. If then our atmosphere, to great heights, had the power of intercepting red rays (reflexion and scattering imply so much) how on earth could the red rays get to the moon?—as, under ordinary conditions, they would, and do.

I am not concerned to show that the self-luminous tufaceous surface of Mr. Williams's theory would send its light through an atmosphere in such a state; for I am in no degree interested in that theory, which seems to me not so much to lie outside knowledge, as to be utterly inconsistent with known facts.

Turning to another point—the difference between the behaviour of a pencil of rays in passing to a focus and the course of the axis of a pencil, is somewhat more important than Mr. Williams imagines. For instance, failing to recognise this difference, Mr. Williams has been led to imagine that the focus of a pencil of rays proceeding from a point on the sun's surface to the earth's atmosphere, thence to pass towards the prolongation of the line joining the centres of the sun and earth, must lie *somewhere on this line*. I am quite sure that nothing in the treatment of optical problems when Mr. Williams was a lad would have encouraged this mistake. As a mere matter of fact, the focus (or rather the primary and secondary foci) of such a pencil, *cannot lie within many millions of miles* of that point on the line in question to which the axis of the pencil is deflected by the action of the earth's atmosphere: *it cannot even lie between the earth and the moon at all.*

Not to mention several other points, Mr. Williams does not appear to have noticed that regarding the layers of air which deflect the sun's rays during the time of solar eclipse, as forming part of a spherically convex lens, the incidence of those rays is *exceedingly oblique*. Can he recall any of the formulæ relating to the construction of optical instruments wherein it is not an express condition that the obliquity of incidence should be so small that it may be either neglected or readily corrected?

I can take two similar prisms and by means of them make the axes of two pencils of rays from a luminous point intersect each other. Is that point of intersection the focus for those rays? On the contrary, each pencil after emergence has its own pair of *foci* and its own "*circle of least confusion*," none of the six lying *anywhere near* the point of intersection of the *axes* of the two pencils. (The more nearly parallel the rays forming the pencils severally are the farther away are their foci from the point of intersection of their axes.) This corresponds precisely with the action of two parts of the atmospheric zone at work during total lunar eclipse, on opposite sides of the earth.

Turning to Mr. Ranyard's letter, I find myself perplexed. He cannot really, I should suppose, misunderstand matters as he seems to do. Yet I have read and re-read and re-re-read his letter, without finding any escape from the conclusion that he has in some way or other gone altogether astray.

For instance, it looks as though he supposed that during the progress of totality, and near the time of mid-totality, layers of our air many miles above the earth's surface are at work in refracting solar rays upon the moon's surface, while layers reaching far above the two miles which he sets as the highest reasonable limit of cloud-layers obstructing the transmitted rays (or rays which but for them would be transmitted) *may* exercise so great an absorptive action as to prevent sunlight from passing through at all.

Be his views what they may, it is certain at any rate that everything in what I have just described as apparently Mr. Ranyard's meaning, is decidedly inconsistent with known optical and physical laws.

Take first the refractive power of the higher layers of our air:—I would not for a moment insist on taking Bradley's empirical law as satisfactory for exact inquiries; but unless this law, which is found to be true for barometric variations of considerable extent, fails *entirely* at high levels, it is certain that the air above 3½ miles, where the barometer stands at a height of only 15 inches, can send *no light whatever* to the moon at the time of mid-totality.

Secondly, it is absolutely certain that air not so cloud-laden or so dustladen, or thick enough, from whatever cause, to render the sun's light faint to us when he is setting, must transmit a considerable amount of light to the moon even in the case of rays grazing the earth,—while rays passing a mile or two from the earth's surface would be absorbed in much less degree, and rays passing ten or twelve miles from the earth's surface would be scarcely absorbed at all.

Thirdly, when there are clouds in the air, those at a height of six or seven or even ten miles, may readily obstruct large quantities of light passing very obliquely athwart their layers. Even when there are only cirrus clouds in the sky, it will often happen that while these clouds are so sparse overhead that they seem to obstruct scarcely any light, they form an impenetrable veil near the horizon.

But the strangest point in my friend's letter is his singular misapprehension—as I understand him—of that imaginary increase of the earth's diameter by 1-60th part which Tob. Mayer was the first to recognise as necessary in dealing with the umbra. Of course he quite rightly recognises the effect of the sun's decrease of lustre towards the edge in increasing the effective extent of the umbra. But the relatively sudden diminution of lustre as the geometrical shadow is approached, and the general uniformity of the tint afterwards need no such explanation as he has devised. Let the refractive effect of our earth's atmosphere do what it may in diminishing the extent of the region in absolute shadow, it can never do more than throw a very feeble light within the geometrical shadow. Moreover the light thus thrown by

the lower three or four miles of the air must be tolerably uniform (apart from clouds breaking the ring of sunlight).

(To be continued.)

THE YOUNG ELECTRICIAN.

By W. SLINGO.

TWO ELECTRIC STATES.

PR. 3.—There are two electric states, usually called positive and negative. These terms are useful and serve their purpose very well; although, perhaps, others a little better might have been chosen. We can use them independently of any views we may hold on the single, double, or no-fluid theories of electricity. As electricity is but a condition of matter, we can scarcely hope to get beyond the bounds of assumption. It is simply a theory, and not an established law or principle, to say that there are one, or two, or any number of electric fluids: what evidence there is is decidedly the other way—that is to say, electricity is a force which is not a fluid, nor does it in many cases behave like a fluid. As, however, we have set ourselves against theorising, let us simply re-assert that there are two electric states or conditions, and let us endeavour to identify them.

Ex. XCI.—Attach the thread or ribbon connected to the paper loop (Fig. 39), or the wire stirrup (Fig. 41), to

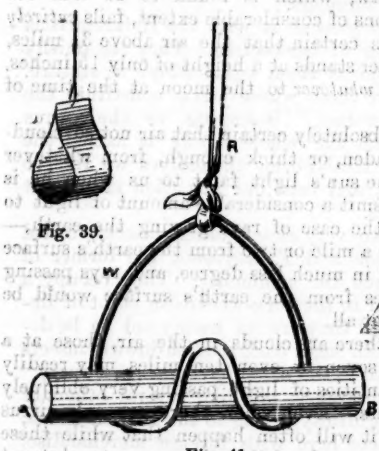


Fig. 39.

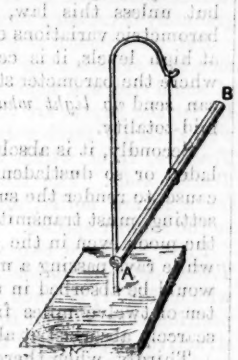


Fig. 47.

Fig. 41.

a support of some kind, such as that illustrated in Fig. 36 (page 495). Fig. 47 shows the arrangement. Any other form of support, however, that suggests itself to the young electrician will do for this purpose, as insulation is not essential. We know (from Ex. LXXIV.) that if an unelectrified stick of sealing-wax, &c., be placed on the stirrup, the approach of an electrified rod results in attraction. Similarly (Ex. LXXIX.) the unelectrified sealing-wax is attracted by an electrified glass tube. So also would the electrified sealing-wax or glass attract an unelectrified glass tube placed in the stirrup. Let, now, the end B of a stick of sealing-wax, say seven or eight inches long, be rubbed with a piece of warm, dry flannel, and placed on the stirrup. Then bring near the end A, another electrified stick of sealing-wax, attraction will ensue; but bring the second stick near the end B, and instead of attraction we shall get repulsion, for the suspended rod will recede from that held in the hand. Lay the second stick on one side in a dry place, and electrify the hot dry glass tube (Ex. LXXIX.). Then bring it near A, attraction takes place, and if the glass be brought near B we get even stronger attraction (instead of repulsion, as with the sealing-wax). Now substitute for the suspended sealing-wax a piece of dry warm glass tubing, say half-an-inch in diameter, and ten or twelve inches long (with—if you have it—one end sealed). The electrified sealing-wax or glass held in the hand will attract either end A or B of the unelectrified glass. But if the end B of the glass be electrified in the usual manner, strong attraction will be exerted between it and the sealing-wax, while it will recede from or be repelled by the electrified glass.

Here, then, we see that electrified sealing-wax attracts electrified glass but repels electrified sealing-wax, and conversely electrified glass attracts electrified sealing-wax and repels electrified glass: clear evidence that there are two electric states, that the states produced on similar bodies by similar rubbers are mutually repellant, while the states produced on dissimilar bodies by dissimilar rubbers produce (although not always necessarily) attraction.

Ex. XCII.—That either electric state is self-repellant may be further demonstrated by a modification of Ex. LXXXV. Draw a piece of narrow silk ribbon between two adjacent fingers provided with india-rubber stalls, and then carefully suspend the ribbon over one of the fingers held out straight, the two halves of the ribbon, being similarly electrified, will repel one another, and take up positions as shown in Fig. 48. The stronger the electrification the greater, of course, will be the divergence of the ribbon.

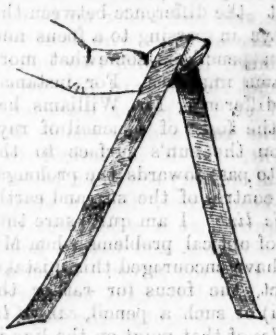


Fig. 48.

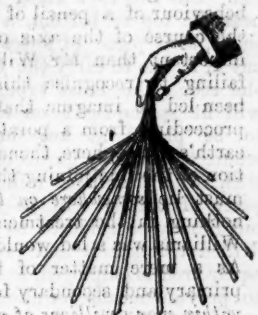


Fig. 49.

Ex. XCIII.—Another interesting experiment may be performed with the sheet of electrified note-paper (Ex. LXXXIII). Having electrified it by rubbing it while laying on a hot, dry board with a piece of india-rubber, cut it into a kind of fringe, but drawing a sharp knife through it several times, making the cuts parallel, and letting them extend nearly the length of the paper. Half an inch, or thereabouts, may be left uncut, that is, sufficient to hold the strips together. Now raise the paper carefully from the board, and fold up what we may call the top of it so as to leave the strips free and hanging downwards. It will be observed that the strips will exhibit decided evidence of being similarly electrified by the energy with which they mutually repel one another, taking up the positions indicated in Fig. 49.

Ex. XCIV.—A very attractive experiment is that illus-

trated in Fig. 50. A stand consisting of a stick of wood, 18 in. or 20 in. long, stuck into a suitable piece of flat wood, say 7 in. or 8 in. in diameter, is provided with a funnel support. This may be arranged in a

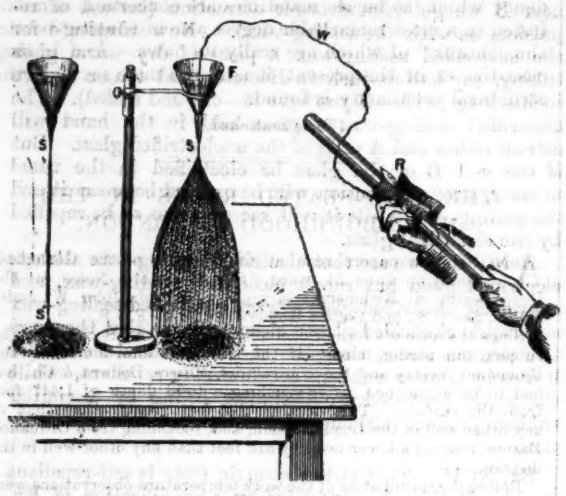


Fig. 50.

variety of more or less simple ways. The simplest, perhaps, is a piece of stout wire, bent approximately into a circular loop, and twisted securely round the upper portion of the wooden rod. If the rod is round, a more elegant contrivance may be easily constructed by procuring a piece of brass tubing about 2 in. long, having an internal diameter *slightly* less than the thickness of the rod. Slit this tube along one side and solder on to it, near the top or bottom, a piece of stout wire bent to shape, or a piece of sheet tinned iron with two holes cut in it, one to carry the funnel, the other to slide over the rod. The brass tube, if of the proper diameter, will fit spring-tight on to the rod, and so enable it to be placed at any height. If it is desired to secure the tube by means of an ordinary screw, or, better still, of a thumb or milled-head screw, then a stout piece of tubing will be required, or a solid piece of metal may be soldered to the tubing, and have a hole drilled through it and tapped for the screw. When a square rod is employed, and it is not thought necessary to provide means for altering the height of the looped arm or carrier, a suitably-shaped piece of tinned iron may be employed, cutting a hole in one end of it for the funnel, and bending the other end at right angles, the bent portion being securely tacked on to the wooden upright. A number of other ways for accomplishing this will doubtless suggest themselves. In the loop or hole place a small glass-funnel, F (procurable at a chemical apparatus maker's), provided with an aperture of about $\frac{1}{8}$ in. in diameter; partly fill it with fine silver sand, and the sand will fall through in a straight column like that indicated on the left side of the support. If, however, one end of a wire, W, be immersed in the sand, while the other end is connected with a glass tube or other body being electrified, the sand will be electrified and self-repellant, when, instead of falling, as previously, in a straight column, it will be constrained to fall after the manner shown in the figure. To ensure success with this experiment a modification of the rubber is necessary. With this we will deal next time.

OUR HOUSEHOLD INSECTS.

By E. A. Butler.

COLEOPTERA (*continued*).

IN order to find the other household members of the Heteromera, we must leave for a time the cellars in which we were hunting for our first representative of the group—the foul churchyard beetle—and visit localities of an altogether different description, viz., bakers' shops, bakehouses, flour-mills, and granaries. Farinaceous substances, such as wheat, barley, maize, meal, flour, bread, cakes, &c., are specially liable to the attacks of various species of beetles, belonging, curiously enough, to several totally distinct sections of the order. In stores of corn in granaries, no less than eighteen species of beetles have been found amongst the refuse, though it is probable that several of these were there, not to eat the grain themselves, but to prey upon such of their associates as were addicted to that practice. Still, it is certain that there is a gang of nearly a dozen species that will engage in this work of destruction whenever they can get a chance, and the ringleaders are those two great sinners, the corn weevils, which we described on a former occasion (See Knowledge, March 28, 1884). Our old friend, the omnivorous *Niptus*, too, sometimes joins the ranks of these "corn-lovers," and Dr. Power records having found it in hundreds in a quantity of meal, which he transferred to a closely-stoppered bottle, where, notwithstanding that the bottle was never opened, the insects continued to breed for three years, though in gradually decreasing numbers.

But our concern at present is with the Heteromerous members of this gang of freebooters. They are chiefly of small size, and none of them equal *Blaps* in stature. By far the largest are those whose larvæ constitute the well-known "meal-worms," belonging to the genus *Tenebrio*, from which the whole family is named the *Tenebrionidæ*. The meal-worms themselves we reserve for a future notice, and turn our attention at present to the smaller species.

First, we have two very closely allied insects, called *Tribolium ferrugineum* and *T. confusum*, the former of which (Fig. 1) is much the commoner. They occupy a position very inferior to the corn-weevils in point of destructiveness, but still they are an enemy not to be despised. They are both small dark reddish-brown insects —a colour referred to in the name *ferrugineum*, "rusty" —of insignificant appearance, and, like several others of the group, do not rightfully belong to the British fauna, having been introduced here with foreign merchandise. They have, however, established themselves, at least under the shelter of human roofs, where they will breed freely, and therefore, though they do not yet appear to have become naturalised in the truly wild condition, they are usually included in lists of British insects.

They are so much alike, that to a casual observer they would appear identical. By a very close and careful comparison under the microscope, minute points of difference in the antennæ, thorax, and punctuation can be made out, but these are of too minute and technical a character to be rendered intelligible here. In the name *confusum*, the "confused," given to the second species, we have an indication of the difficulty that attends their separation, and of the probability of their being confounded together. There is one peculiarity, however, possessed in common by these insects and their allies which is worth notice. It is that the eyes, which look like piles of tiny, polished black beads, are much encroached upon by a projecting

ridge in front of the head, which is produced backwards in such a way as to appear to have grown partially across the eyes, almost entirely dividing each mass into two unequal parts, one above, the other beneath.

The larvæ of these insects are tolerably active, somewhat hairy creatures with six short legs in front. In common with larvæ generally they change their skin several times, each time making their exit from the slough through a slit along the back of the neck, dragging out therefrom, first the segments that afterwards become the thorax, then the head and legs, and finally the abdomen. Previously to assuming the pupal form, they become restless, and search about for a suitable place of lodgment; having found one to its taste, the grub arches its back and divests itself of its last larval skin, and then passes very rapidly through the resting stage of pupadom, appearing in an incredibly short time as a perfect insect, ready again to take part in the activities of life. At first it is pale, and the elytra are so transparent that the body can be seen through them; after a few days, however, they acquire their characteristic ferruginous colour and opacity. The pupa shows distinctly all the parts of the perfect insect, the head, wings, and legs being bent down underneath the body.

Fig. 1.—Tribolium ferrugineum.

Fig. 2.—Head of Gnathocerus cornutus (much magnified).

These insects do not confine their attentions to farinaceous substances; they are also animal feeders, and are amongst the enemies to be dreaded by the keeper of collections of natural objects; their larvæ will excavate the carcase of a dried insect as effectually as will those of *Dermestes* or *Anthrenus*.

Another bakehouse insect is *Gnathocerus cornutus*, which is identical in colour with *Tribolium*, and very similar in shape, but somewhat larger. Its names, *Gnathocerus*, "jaw-horn," and *cornutus*, "horned," both refer to a peculiarity of the male only, by which that sex can be easily distinguished from all other members of this group. The mandibles, *i.e.*, the biting jaws, are each in the form of a long horn, the pair of which, projecting considerably in front of the head, and curling upwards, give the insect a most formidable aspect. The head is altogether an odd-looking object (Fig. 2), for, besides these mandibular horns, there are two blunt horns on the forehead, and the ridge that almost divides the eyes is produced into a kind of flap or scoop on each side.

By these remarkable structures we are reminded of what seems almost like a law in the insect world, viz., that of all the different parts that make up the whole organism of a typical insect, there are some, such, for example, as the legs, that preserve a very great uniformity of type throughout the class, varying in the different groups, and through the thousands upon thousands of species, only within comparatively narrow limits, while others seem possessed of much greater plasticity, so to speak, and run off occasionally into such eccentricities, extravagances, and apparent monstrosities, that it seems as though there were no limit to the modifications of which they are capable. Perhaps the best illustrations of this are to be found in the thorax and antennæ, in both of which most marvellous and unexpected developments, both in shape and size, are to be met with. And in our present insect we see the head and mandibles partaking of this same tendency to fantastical modification, a tendency which, so far as mandibles are concerned, is manifested in a most remarkable degree also in the stag-beetle, the "horns" of which are really its jaws. And in that case, too, as in the present, it is in the male sex that the structural peculiarity is found.

(To be continued.)

THE DEEP-SEATED ROCKS IN THE NEIGHBOURHOOD OF LONDON.

AMONG the papers read at the meeting of the Geological Society on June 24, were "Supplementary Notes on the Deep Boring at Richmond, Surrey." By Prof. John W. Judd, F.R.S., Sec.G.S., and Collett Homersham, Esq., F.G.S.

Since the author's former communication to the Society on the subject, this boring, in spite of the strenuous efforts made by the Richmond Vestry and the contractors, Messrs. Docwra & Co., has had to be abandoned, after reaching a total depth of 1,447 feet from the surface. This depth is 145 feet greater than that of any other well in the London Basin, and, reckoning from Ordnance Datum, reaches a lower level by 312 feet than any other well in the district.

Before the termination of the work temperature-observations were obtained, which, generally, confirm those previously arrived at.

The strata in which the boring terminated consisted of the red and variegated sandstones and marls previously described, which were proved to the depth of 208 feet. Although it was demonstrated that these beds have a dip of about 30 deg., complicated in places by much false-bedding, no conclusive evidence could be obtained concerning their geological age. They may be referred either to some part of the Poikilitic series, or to the Carboniferous (for similar strata have been found intercalated in the Carboniferous series at Gayton, near Northampton), or they may be regarded as of Old Red Sandstone age.

Some interesting additional observations have been made since the reading of the former paper, on the Cretaceous rocks passed through in this well. Mr. W. Hill, F.G.S., of Hitchin, has found the exact analogue of the curious conglomerated chalk met with at a depth of 704 feet at Richmond. His observations entirely confirm the conclusion that we have at this depth the "Melbourne Rock" with the zone of *Belemnites plenus* in a *remanié* condition at its base. Some new facts concerning the state of preservation of the fossils in the Chalk Marl are also recorded.

With respect to the conclusions arrived at by the author concerning the distribution of the Jurassic rocks on the south side of the London Basin, an important piece of confirmatory evidence has been supplied by a deep boring made at the Dockyard-Extension Works at Chatham. This section, for the details of which the authors are indebted to the officers of the Geological Survey, shows that under the Chalk and Gault, with normal characters and thickness, there lie 41 feet of sandy strata of Neocomian age, and that these are directly underlain by blue clays of Middle Oxfordian age, as is proved by the numerous fossils which they have yielded. We have now, therefore, direct evidence of the existence and position of strata of Lower, Middle, and Upper Oolite age, respectively, beneath the Cretaceous rocks of the south-east of England.

IT is said that the applications for space and concessions at the American Exhibition to be opened at Earl's Court, London, on May 1, 1886, are arriving in great numbers.

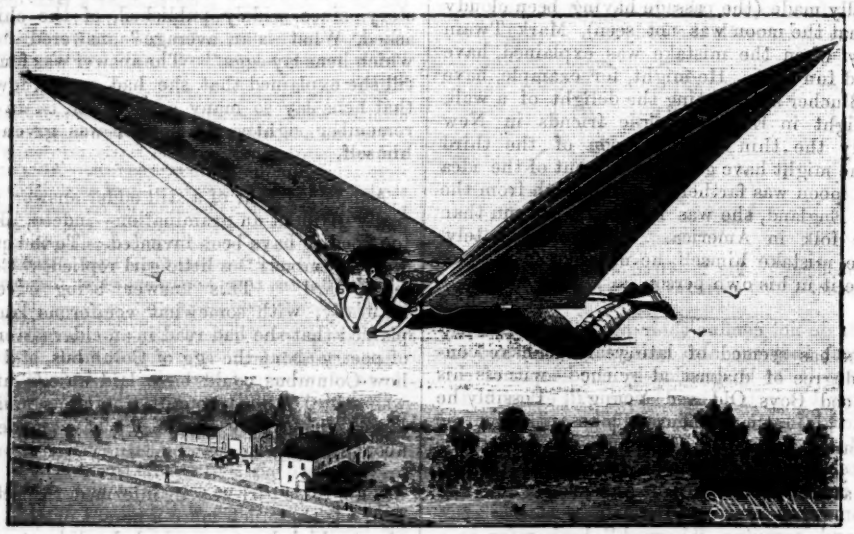
PEPPERING SPARROWS.—A trouble arises to those who train ivy and other vines on the sides of their dwellings from the noisy sparrows, who make their homes and build their nests in the branches, and chatter and quarrel to the annoyance of their inmates. The writer, after trying many expedients for getting rid of his tormentors, was most successful in the use of shot. A handful flung into the vines had the effect, after a few applications, of driving the chattering throng away, but they returned in less numbers in a few days. But another has tried a plan which we should think would be more effective. He scatters red pepper from a window above into the vines, and he says the birds evinced their dislike to cayenne by taking their departure, and that he has been comparatively free from their annoyance since.

XUM

A NEW FLYING-MACHINE.*

THE easy and graceful flight of birds through the air has for the last hundred years been a problem occupying the acutest minds. Attempts have been made during the same period to imitate the motion of the bird in ethereal space, either by the aid of the application of the balloon or by the use of the muscles of the human body alone. Attempts in this direction, although none have as yet been crowned with success, are praiseworthy, and doubtless will in time achieve a fair degree of success. The accompanying engraving represents a flying-machine, which is the invention of Dr. H. P. Booth, of Chippewa Falls, Wisconsin. The fundamental principle of this flying-machine is in using simultaneously every important muscle of the body for the purpose of elevating the body and propelling it forward through the air.

In harness a man has lifted 3,500 pounds, and this wonderful result is achieved only by allowing every muscle to act simultaneously to its fullest capacity, and under the most advantageous circumstances. This flying machine is merely a harness, by which the human body



acts to its best advantage, to the end that it may be both lifted and propelled; and if flying by muscular force alone is ever accomplished, it must be by using all the power there is in the human frame. In this machine there are two wings, each of which is from 12 ft. to 15 ft. long, and the breadth equal to the length of the operator, from his shoulders to his feet. The frame of the wings consists of three bamboo poles lashed together, and bent to suitable shape, and covered with silk. A cord extends from one extremity to the other of each of these wings (that is, from the heel to the tip), which serves to give the wing proper shape and tension, being covered by the silk of the wing.

The wings are provided with suitable valves, which open on the upward and close on the downward movement. The frame of the wings forms a right angle in front of the shoulders, and below the breast of the operator, as shown in the engraving, and to these is attached two strong ropes of raw hide. Each of these ropes passes from the wing to which it is attached to the shoulder of the operator, who is supplied with a suitable collar, which supports the frames of the wings loosely, and runs along the back, forming a pair of loops for the feet to pass through. When the body is forcibly straightened, the wings are brought down with all the power of the most powerful muscles of the body, as is shown in the engraving, and this movement is also assisted by the strong muscles of the arms, operating the wings from the under side. Over the shoulders, extending from one wing to the other, is a strong rubber spring, the tendency of which is to lift the wings, thus assisting the arms in the upward movement. If desired, the hands, instead of operating the wings from the under side, may grasp the short lever forming the base of the wing, and thus make use of more powerful muscles of the arm than if the arms are extended. Which of these is best is, of course, a matter to be determined by experiment. Each wing may be operated independently of the other, it being only necessary to operate one foot or the other to give each wing just such a movement as may be desired. A canvas extends from the base of one wing to the other, forming a sort of stretcher, upon which the operator rests. From the lowest point of the base of the wings are several small stay ropes running to different points of the wings, which serve to stiffen and strengthen them. In this device the body of the operator offers the least possible resistance to the air, he being in precisely the same attitude that a bird is in during flight. The parts of the apparatus are constructed of the lightest as well as the strongest materials.

* From the *Scientific American*.

SIXPENNY TELEGRAMS.—As we anticipated, sufficient interest in the New Telegraph Acts Amendment Bill has been excited to forbid its summary dismissal. Lord John Manners' statement in the House on Monday evening has met with a very favourable reception, and we may take it for granted that no time will be lost in introducing the reform. Prophesying is dangerous unless you know, but it is safe to express an opinion that we shall be able to use the wires at the reduced rate in October next.

THE country spent a very large sum of money on the *Challenger* expedition, and now that the narrative has been published, it has been done under the red-tape rule for dry-as-dust reports, and to cover the cost of production no less than £6. 16s. 6d. is being charged on the 750 copies published. Here is a book, the materials for which were obtained at public expense, being published at a price which precludes 99 per cent. of those who would like it from even a hope of getting it. Government encouragement of scientific research will not gain much public favour this way.—*The Engineer*.

Gossip.

By Richard A. Proctor.

In an article which I once wrote on "Finding the Way at Sea," I poked a little fun at Mark Twain's odd mistake about the moon at sea. It will be remembered that the mistake was on this wise:—Because the ship, travelling eastwards, made the sun rise (and also set and "south") about twenty minutes *earlier* day after day, and because the moon rises (and also sets and "souths") about twenty minutes *later* day after day,—therefore the moon remained unchanged to him and his fellow-passengers as they travelled eastwards: "To us Joshuas," as he puts it, "she was a full moon all the time,"—which of course is absurd. Some one answered in an American paper that it was absurd of me to take Mark Twain in earnest. But this was to insult Mark Twain as a humourist; of course his joke was limited to the introduction of Joshua. If Mr. Blucher had made the mistake about the moon, in anticipation, which Mr. Clemens actually made (the passage having been cloudy I suspect, so that the moon was not seen), Mark Twain might probably, when the mistake was explained, have made very good fun of it. He might, for example, have pictured Mr. Blucher anticipating the delight of a walk by full moonlight in England while friends in New York had only the thin waning moon of the third quarter. Or he might have got good fun out of the idea that while the moon was farther than the earth from the sun for folk in England, she was nearer to the sun than the earth for folk in America. But, unfortunately, falling into the mistake himself, he missed the joke, or rather he made it in his own person.

Mark Twain has seemed of late years to have conceived some degree of disgust at science—witness his "Fables for Good Boys, Old and Young." Possibly he thought that his rather laboured jokes at scientific methods and language, might cause men to forget the more splendid joke he had made unwittingly at his very first scientific attempt.

Be this as it may, he has succeeded recently in imagining a scientific blunder almost as funny as his self-made one. Students of science have occasionally extended numbers, good for a particular era, somewhat too boldly into far remote eras in the past and in the future. It has always happened in such cases that other students of science have pointed out the mistake and indicated the limits of time within which such calculations must be kept. Of course, there have been cases where the self-styled religious have made more noise over such points than students of science, as in the famous case where a preacher in America proved to his own satisfaction that Niagara had begun to cut the channel which it assuredly has cut, at about the time assigned by Bishop Usher to the Creation, and was rather staggered at being told that it was awfully wicked of him (by his own showing about others) to say so, for that left no time for the deposition of the rocks cut through, which tell of periods at the very least ten times as long. But usually, outside corrections have been rather petulant than amusing,—and science has had the work of sound correction, or the task of exhorting to caution, altogether to herself.

It will be understood, then, how much point there is—let the fun in it be what it may—in the following remarks by Mark Twain:—

In the space of 176 years the Lower Mississippi has shortened itself 242 miles. This is an average of a trifle over one and three-tenth miles per year. Therefore, any calm person, who is not blind or idiotic, can see that in the old oolitic Silurian period, just 1,000,000 years ago this month, the lower Mississippi was upward of 1,300,000 miles long, and stuck out over the Gulf of Mexico like a fishing-rod. And by the same token any person can see that 742 years from now the Lower Mississippi will only be a mile and three-quarters long, and Cairo and New Orleans will have joined their streets together, and be plodding comfortably along under a single mayor and board of aldermen. There is something fascinating about science. One gets such wholesale returns of conjecture out of such trifling investment of fact.

Also, dear humourist, one can so easily make glorious blunders, and get so absurdly and so unnecessarily annoyed over them.

The Bishop of Hereford, when he was Dr. Jas. Atlay, Fellow and Tutor of St. John's College, Cambridge, and head of the side to which I belonged, used to tell the story, since widely published, of the child who being asked, What is an average? answered "Something on which hens lay eggs." The answer was found perplexing, till she explained that she had seen, a few days before, that hens lay so many eggs a year, *on an average*. If I remember rightly the answer was given to Dr. Atlay himself.

And now I hear of a still odder answer, as having been really given at an examination—indeed, like the last, it is too good to have been invented. To the question, "Who was Columbus?" a little girl replied, "Columbus was a large bird." This answer being received, perhaps naturally, with somewhat vociferous laughter, she explained that she had read in an elder sister's book, a piece of poetry about the egg of Columbus, and she did not see how Columbus could have laid an egg unless Columbus was a bird. She thought Columbus must have been a large bird, or they would not have made so much talk about his egg.

This little girl was ill-informed respecting Columbus. But was she much more ignorant on this special subject, about which be it remarked she did not pretend to know anything, than a certain archdeacon was of law, when, uninvited, he suddenly amazed lawyers by saying that "Drinking is the only vice of which we can cut off the entail"? which as a well-known writer remarked would imply that Archdeacon F. wished us to obtain the fee simple or possess the whole drinking estate.

Or than the Welsh clergyman, who without any occasion to stagger his audience by astronomical profundities, told them that "So many stars make a planet; so many planets make a constellation; so many constellations make a Milky Way; and six (!) Milky Ways make an Aurora Borealis"?

I wonder by the way whether in the closing statement of this scientific Welshman, there may not be a sort of development of a story I am fond of telling in one of my lectures—viz., how at a certain middle-class examination, in reply to the question, "What is the Milky Way?" there came the answer,—"The Milky Way is a kind of cloud in the sky, called the Trade Winds, or the Aurora Borealis."

Reviews.

SOME BOOKS ON OUR TABLE.

Suicide; its history, literature, jurisprudence, causation and prevention. By W. Wynn Westcott, M.B., London. (London: H. K. Lewis. 1885.)—Alike by the sociologist, the moralist, the student of medical jurisprudence, and the psychologist, will Mr. Westcott's volume be found interesting. He has obviously brought to its composition wide reading and painstaking research, in addition to the practical knowledge of his subject derived from his official position as Deputy Coroner for Middlesex. In fact, he has supplied a distinct want in the English literature of suicide, inasmuch as he covers succinctly the whole field of the question of self-destruction; while the most recent work immediately preceding his (we refer to the translation of Professor Morselli's work in the "International Scientific Series") consists almost wholly of statistics, which, however valuable for special purposes, scarcely commend themselves to the great majority of readers. Ranging, as we have said, over the whole field of self-murder, our author treats on the ethics, history, jurisprudence, rate of increase, causation, and means of suicide; as also of its prevention, incidentally giving accounts of the most notable suicides, ancient and modern, the curious epidemics of this crime which have from time to time prevailed, &c. In the unhappy presence of the fact that a notable increase in the percentage of suicides appears to have taken place in this country within the last few years, the importance of Mr. Wynn Westcott's book will be recognised, and we can only hope that its circulation will be commensurate with its merits. In such case it cannot fail to be very extensive.

How to Get Strong, and How to Stay So. By William, Blaikie. With illustrations. (London: Sampson Low Marston, Searle, and Rivington. 1880.)—This is an English reprint of an American work, in which minute and detailed instructions are given for gymnastic exercises suited to all sorts and conditions of men, and, incidentally, of women and children too. In point of fact, we are not sure that the ladies will not be as much interested in Mr. Blaikie's excellent book as the men themselves; inasmuch as the explicit directions it contains for developing various individual muscles will enable the fair sex to attain the most perfect symmetry of form, in glorious independence of the various adventitious aids of whalebone and wadding. Among the other amusing chapters in the volume before us is one illustrating the importance of gymnastic training for our police and firemen. Readable as the book is, it derives some additional piquancy from its slight American peculiarities of diction. By what we can only regard as an odd coincidence, an appendix contains such tables as were asked for a week or two ago by a correspondent (Mr. J. H. Ward), to whom the Editor would seem to have replied on p. 14.

Lessons in the Art of Illuminating. By W. J. Loftie, B.A., F.S.A. (London: Blackie & Son.)—To the patient love which prompted the Irish ecclesiastics some 1,200 years ago to beautify and adorn their MSS. with elaborate ornamentation in colour, we are indebted for an art which culminated in this country during the earlier part of the thirteenth century, when the fame of the Scriptorium at St. Alban's was at its height. Certainly no one can inspect some of the marvellous specimens of artistic work in the shape of Bibles, Psalters, and Horæ in the National Collection at the British Museum, without being struck with a kind of dumb amazement at the industry, persistence, and perseverance which must have been exercised in their production. That so refined a form of art should have been revived in these days will cause no surprise in the mind of any one who will consider how the sense of the Beautiful has been, and is being, developed among us, and how it is made to minister to our gratification in every way, in our dwellings, surroundings, and common articles of use. To all who may wish themselves to reproduce anything akin to the glorious achievements of mediæval days, to help towards effective Church decoration, or even to adorn a photographic album, Mr. Loftie's book will be welcome. He gives minute general instructions for illumination, as an introduction to detailed descriptions of the working of every one of the very numerous illustrations which crowd his handsome volume. When we say that it forms one of Vere Foster's Water-Colour Series, we need not add that the coloured facsimiles of illuminated MSS. are admirably executed.

The Skilful Cook. By Mrs. Mary Harrison. (London: Sampson Low, Marston, Searle, & Rivington. 1884.)—Simple and perspicuous in her language, and at once plain and methodical in her detailed instructions for the preparation of every one of the very numerous dishes she describes, Mrs. Harrison has produced a book which every lady should present to her cook forthwith. Indeed, we may say *en passant*, that it will not be wholly without advantage if the gift be previously carefully studied by the donor herself. For the servant who will thoroughly master the contents of this small volume will truly be entitled to rank as "a skilful cook," and will assuredly find her market value very considerably enhanced by such mastery. In addition to the receipts proper, fourteen pages are devoted to menus, a part of the work which will be found very valuable by the young housekeeper. The very cover of the book, with its red leather back, is a sensible one, and suggests the idea that it is meant for *bonâ-fide* kitchen use.

Observations on the Preparation of Mineral and Rock Sections for the Microscope. By John Ernest Ady. Reprinted from the *Mineralogical Magazine*.—The study of petrology, or that of rocks in their mineralogical and minute structural rather than in their massive character is comparatively modern. It is mainly to Mr. H. C. Sorby that we are indebted for our knowledge of their microscopical characteristics. The slightest consideration will show, however, that it is impossible to investigate the minute structure of rock without reducing it to a thinness which shall enable it to transmit light, and to this end it must be sliced, subsequently ground and polished, and mounted in Canada balsam. In this pamphlet, Mr. Ady gives an illustrated description of the entire process. It will be found very useful to beginners intending to employ it.

Our Corner. May 1, 1884. (Freethought Publishing Company.)—This is sent to us as containing an exposition of "Hylo-Idealism," by "C. N." Any one interested in that hypothesis will find it developed here.

Cope's Tobacco Leaves. Part I. May, 1885. (Liverpool: Office of "Cope's Tobacco Plant.") This is made up of a very heterogeneous selection of essays, all, however, bearing more or less on what the elder Mr. Weller called "the flagrant veed." The frontispiece is a copy of Adrian Ostade's well-known "Smoker," and other illustrations are scattered through the text. Every smoker—and we may add non-smoker too—will find something here to amuse him.

Where to Find Ferns. By FRANCIS GEORGE HEATH. Illustrated. (London: Society for Promoting Christian Knowledge. 1885.)—Here is a little book to be carried in the pocket of the fern-hunter "whene'er he takes his walks abroad." It gives a general account of Ferns, their structure, fructification, and manner of growth, together with an explanation of the technical terms used in describing them. This is followed by a profusely illustrated chapter on "Fern Habitats," and by a shorter one on the cultivation of ferns. After this all the British species are described seriatim, each in a small chapter, in which every description is followed by a list of the places where the fern to which it refers is found. Chapter L., on "Ferns round London," may be studied with pleasure and profit by all holiday-makers, the low price at which the volume is issued placing it within the reach of almost everybody.

Ambulance Work. By R. LAWTON ROBERTS, M.D. (London: H. K. Lewis. 1885.)—The volume before us consists of a reprint of five lectures delivered by Dr. Roberts to ambulance classes held in connection with certain Welsh collieries and ironworks. The first one gives a *précis* of human anatomy and physiology; the second deals with hæmorrhage or bleeding, the third with fractures, the fourth with sudden attacks of illness, suffocation from various causes, &c., while the concluding one is devoted to describing how to lift and carry the wounded. Simple and apprehensible in diction, and well illustrated by thirty-eight capital woodcuts, this is a work which must commend itself to every one liable either to accident in his own person or to be called upon to render aid in the case of another.

Moffatt's Geographical Reader. Nos. I., II., III., and IV. (London: Moffatt & Paige.)—If we needed an illustration of the manner in which the teaching of geography has improved of late years, we should find it in the four volumes lying before us. As far as our recollection of our own maiden essays in this department of knowledge are concerned, we seem to remember it as rather a dreary subject than otherwise; but the compiler or compilers of this series has—or have—certainly succeeded in rendering it both amusing and attractive. The common sense of the method pursued in Volume I. of teaching a child what places in its own neighbourhood look like in a map must commend itself to every one.

History of the Statistical Society. By FREDERIC J. MOUAT, M.D. (London: Edward Stanford. 1885.)—In this pamphlet Dr. Mouat gives the history of the Statistical Society from its inception in 1834 down to the date of the celebration of its jubilee. Heretical outsiders, seeing how anti-vaccinators and the like manipulate statistics, are apt to believe that *anything* can be proved from them if skilfully cooked. Those who, in accordance with the sound old maxim, *audi alterem partem*, care to hear the case as ably put by the other side, should read Dr. Mouat's book.

The Child's Pictorial, (Society for Promoting Christian Knowledge)—is, with its gaily-coloured illustrations, as bright and taking as ever.

WE have also on our Table *Bradstreet's, The Sanitary News, Wheeling* (a marvel of "wheel" information, gossip, and fun at an almost nominal price), *The Medical Press and Circular, Electricité, The Mason College Magazine, The Tricyclist*, and from Messrs. Cassell & Co., *The Countries of the World, Cassell's Household Guide, The Book of Health, Our Own Country* (as delightful as ever), *The Library of English Literature, European Butterflies and Moths*, and *Cassell's Popular Gardening*, one and all sustaining their already well-earned reputation.

THE FACE OF THE SKY.

FROM JULY 17 TO JULY 31.

BY "F.R.A.S."

DAILY watch should be kept upon the Sun for spots and faculæ. Map VII. of "The Stars in their Seasons" exhibits the aspect of the night sky. Minima of Algol will occur at 1h. 10m. a.m. on July 26, and at 9h. 58m. p.m. on the 28th. On and after the 21st, twilight will cease to persist all night, and there will be a short—but, of course, gradually increasing—period of real darkness. Mercury and Venus, which are in conjunction at two o'clock this afternoon, may both now be picked up with the naked eye after sunset over the W.N.W. horizon. Mars is invisible, a remark which applies to Saturn, Uranus, and Neptune, and Jupiter is so very low down by the time it gets dark, as to be almost beyond the reach of the observer with the telescope. We append a list of the phenomena of his Satellites which may possibly, though, perhaps, not very probably, be observed. On the 20th, the shadow of Satellite III. will enter on Jupiter's disc at 8h. 57m., and the Satellite itself quit his opposite limb at 9h. 21m. On the 22nd, the transit of Satellite I. will begin at 8h. 55m., and Satellite II. pass off the planet's face at 9h. 4m. On the 23rd, Satellite I. will reappear from eclipse at 9h. 9m. 54s. On the 29th, the transit of Satellite II. will begin at 8h. 57m. On the 30th, Satellite I. will be occulted at 8h. 9m., and on the 31st, Satellite II. will reappear from eclipse at 7h. 49m. 44s., and the egress of the shadow of Satellite I. happen at 8h. 22m. The Moon enters her first quarter 19·8 minutes after midnight to-morrow night (the 18th) and will be full at 2h. 22·8m. a.m. on the 27th. Three occultations, all of stars of the 6th magnitude, will occur during the next fortnight. The first happens on July 18, when m Virginis will disappear at the Moon's dark limb at 10h. 10m. p.m., at an angle from her vertex of 184°; reappearing at her bright limb at 10h. 27m., at an angle of 215° from her vertex. Then on the 20th, o^1 Libræ will disappear at the dark limb at 10h. 58m., at a vertical angle of 136°, and reappear at the bright limb of the moon at 12h. 1m., at an angle from her vertex of 272°. Finally, on the 22nd, 29 Ophiuchi will disappear at her dark limb at 10h. 31m., at an angle of 33° from her vertex; reappearing at the bright limb at 11h. 1m., at a vertical angle of 356°. The Moon is in Virgo all day to-day and to-morrow, crossing the boundary into Libra at 5 p.m. on the 19th. There she continues until 6 p.m. on the 21st, when she enters the narrow northern strip of Scorpio. Ten hours later—*i.e*, at 4 a.m. on the 22nd—she has traversed this and entered Ophiuchus. Through this her path continues until 2 a.m. on the 24th, when she enters Sagittarius, out of which, at 4h. 30m. p.m. on the 26th, she passes into Capricornus. Her journey through Capricornus is completed by noon on the 27th, at which hour she enters Aquarius. She is travelling across Aquarius until 6 p.m. on the 30th, when she enters Pisces. There we leave her.

THE census of the population of Austria at the close of 1884 has just been published. The total was 22,864,106, of whom 11,170,468 were males, and 11,693,638 females.

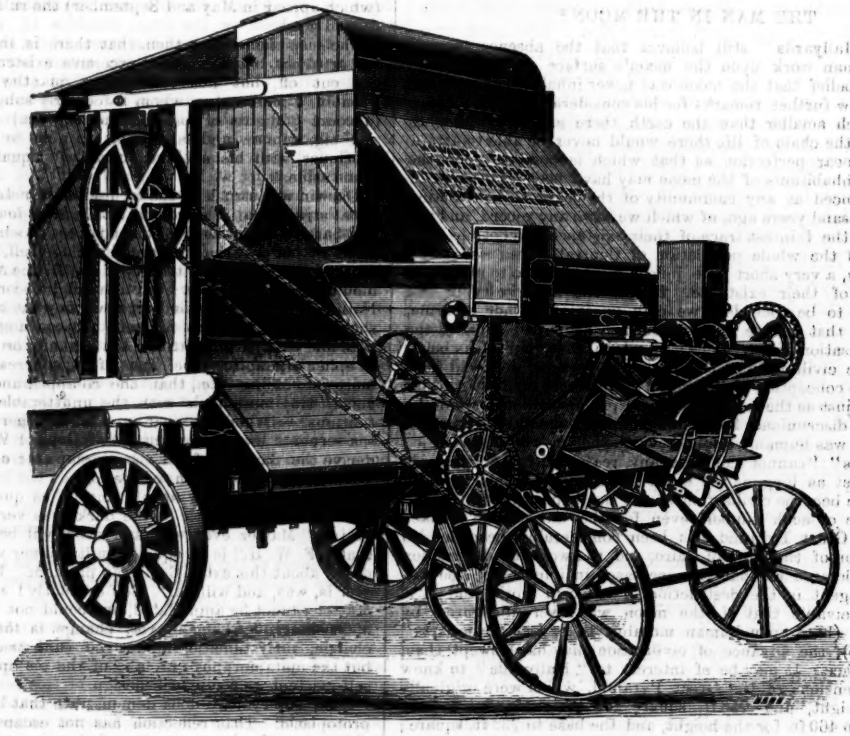
PHOTOGRAPHIC APPLIANCES AT THE INVENTIONS EXHIBITION.—We have frequently alluded in these columns to the increasing popularity of photography as a fashionable amusement amongst amateurs, and no stronger evidence of this could be adduced than the extensive and varied display of photographic materials and appliances to be seen in the South Central Gallery of the Inventions Exhibition. We have already explained that this popularity is owing in a great measure to the substitution of dry for wet plates, whereby the cumbrous paraphernalia requisite for photography under the old conditions was at once abjured in favour of light portable apparatus, and all the disagreeable associations of chemical sensitising by the operator were dispensed with; but a personal examination of the exhibits referred to is necessary in order to fully realise how much has been done by manufacturers of photographic appliances to render the pratice of the art a luxury rather than a bore. The stall of Messrs. Marion, of Soho-square, is noticeable for the extreme simplicity and effectiveness of many of their novelties, amongst which may be mentioned compact sets of everything necessary for taking pictures—practical working instruments, not toy articles—some of them, at the very moderate cost of thirty shillings; they also exhibit dry-plates known as the "Extra Rapid Britannia," which are extremely easy to work, and give good results in the hands of amateurs. These improvements have rendered photography a fashionable amusement amongst Englishmen at home, whilst its charms have already been acknowledged by our cousins in the United States, and will doubtless soon become equally popular in the Colonies.

Our Inventors' Column.

We give here, week by week, a terse description of such of the many inventions as we think may be of use to our readers. Where it is possible, the number of the patent is quoted, to enable those who desire fuller information to procure the specification from the Patent Office in Cursitor-street, Chancery-lane. We shall, generally speaking, confine ourselves to the more recent inventions; but it often happens that an article comes under our notice which, although not quite novel, is worthy of mention for its utility and ingenuity. In such a case we should not hesitate to refer our readers to it. And while we thus increase the interest of our pages, we at the same time assist the inventors by giving greater publicity to their inventions (KNOWLEDGE *being a popular magazine) than is accorded by the most excellent trade journals.*

STRAW-TRUSSING MACHINE.

[Patent 6,759. 1884.]—The accompanying illustration represents Howard's Straw-trussing Machine, fitted with Marshall's feeding arrangement, attached to a threshing-machine for work.



This straw-trusser will bind into sheaves, automatically, the whole of the straw as it leaves the shakers of a threshing-machine. It requires no attention beyond the removal of the sheaves as they are delivered from the binder; and except the cost of the twine, saves the labour of the several men necessary for binding the straw into sheaves by hand. The average cost of twine required to bind a ton of straw is a shilling, which is not more than the expense in labour of making straw bands to bind the same weight of straw.

The machine is easily understood and readily managed; it is very portable and compact, and being mounted on three travelling wheels, is rendered convenient for the application of shafts, horse or bullock pole for draught, or it may be coupled to the back end of a threshing-machine by a suitable draw-bar, and removed from place to place in this way, either by horses or a traction-engine. No fixing or securing to the thresher is necessary for work, the trusser being simply wheeled to the machine, and the driving-chain attached.

The straw on leaving the shakers of the thresher slides down the side of the hopper of the trusser, and is carried forward by the revolving rollers to the collectors, which receive and compress it against weighted levers; and when the required quantity of straw is collected to balance and move the weighted levers, the binding mechanism is thereby started, the pair of binding arms from below the collected straw rise up, enclose and bind it with two bands, while the truss is under compression. The sizes of the trusses may be regulated to suit different requirements.

RUDDER FITTINGS.

[Patent No. 10,575. 1884.]—This invention, by Mr. H. Emanuel, provides the means of instantaneously shipping or unshipping the rudder, by day or by night, while a boat is afloat or under way. It is manufactured throughout of non-oxidising metal, and the barrel is hard drawn. Those who have had any experience of sailing can understand the difficulty of shipping and unshipping a rudder in the water, and more particularly in the dark, attached by the ordinary method of pintles and eyes. Mr. Emanuel's plan is to fix a slotted barrel to the transom of the boat in lieu of the usual gudgeons; and as the rudder carries between its straps a continuous spindle, the latter only requires to be inserted in the bore of the barrel to at once fall into working position by the force of its own weight.

STAIR CLIPS.

[Patent No. 12,614. 1884.]—These new stair plates or nozings, patented by Mr. F. W. Hembry, Newgate-street, London, are a combination of metal-gauze and India-rubber, and are claimed to be superior to the old form in brass and iron. The metal-gauze is first placed upon a backing usually of a thin rubber cloth-like texture, which is coated thickly with rubber cement. Above this wire gauze or perforated metal plate is again spread a quantity of cement, which not only passes through all the holes of the mesh but also is the means, after vulcanization, of firmly securing the rubber on the surface. This being bent to its proper form, and vulcanized becomes one of the best protections against falling or slipping, and prevents the wear and noise on stairs.

THE PANAMA CANAL.—At the close of 1884 the Panama Canal Company had no less than 20,239 agents and workmen in its employment. The duration of each working day has been fixed at ten hours, viz., from 6 to 11 a.m. and from 1 to 6 a.m.

"Let knowledge grow from more to more."—ALFRED TENNYSON.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

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THE MAN IN THE MOON?

[1812]—"Hallyards" still believes that the absence of any traces of human work upon the moon's surface is sufficient to warrant the belief that the moon was never inhabited; I venture therefore a few further remarks for his consideration. The moon being so much smaller than the earth there is every reason to suppose that the chain of life there would never be able to attain a degree so near perfection as that which is possible upon the earth. The inhabitants of the moon may have been cave-men, or even as advanced as any community of the *genus Homo*, existing over five thousand years ago, of which we have any record, and yet have left not the faintest trace of their existence perceptible from the earth. If the whole population of Central Africa were annihilated to-day, a very short time indeed would suffice to obliterate all evidence of their existence. But if the superiority of the Lunarians is to be conceded, we may go to the other extreme, and suppose that before their extinction they had excelled the present civilisation of our globe; in which case, our ideas being limited to the civilisation of the past and present, we could form absolutely no conception of the works of a greater civilisation or of their ruins; just as the intelligence of a pre-historic man would be powerless to discriminate between Fingal's Cave and St. Peter's at Rome, which was human work and which the work of nature.

"Hallyards" "cannot conceive any reason why the Pyramids should not last as long as the earth itself." The primary reason appears to be because civilisation shows no disposition to tolerate the existence of such lumber, even for the antiquarian's sake; already the Great Pyramid has been considerably despoiled to build a portion of the City of Cairo, and the work of destruction will be accelerated as that city increases in importance; so far, man is an agent in the destruction of his own work, and it is readily conceivable that if the moon was ever disfigured by "ramparts" (hard upon human morality to expect "ramparts" to outlast it), the advance of civilisation may have swept them from its surface. It may be of interest to "Hallyards" to know that the dimensions of the Great Pyramid, which were originally 480 ft. in height, and 756 ft. square for the base, have been diminished to 460 ft. for the height, and the base to 732 ft. square; truly nothing wonderful for the work of four thousand years, if we compare it with other human erections, but still sufficient to rob it of its fame for stability; and although in its position it is favoured with atmosphere and weather less destructive in their effects than are common to most countries, its stone, two specimens of which I have before me as I write, show decided traces of natural decay. The Pyramids may be "as durable as any hill," as "Hallyards" says, but the hills themselves are susceptible enough to changes; for instance, those at Tunbridge Wells, which he considers to have been "abraded chiefly by storms."

"In an airless, waterless world like the moon what could destroy our great human works?" Nothing, perhaps, but the presence of such works in the first case, would indicate that there had been both air and water in times past, and the process of demolition may have been completed ages before the water was absorbed or the air had disappeared. (Query—since the oxygen of the air is being continually consumed by both organic and inorganic matter, does not this, to some extent, explain the rarity or absence of an atmosphere on the moon?)

I have seen a description of the so-called lunar canal, and also a criticism throwing discredit upon its human origin, but in what work or journal I cannot recollect.

Having little time to spare at present, I will take up the other points in his answer to my letter by and by. ALEX. MACKIE.

[Oxygen is not "consumed" in the sense used by Mr. Mackie. Oxygen goes into the lungs of animals, combines with the carbon contained in the different parts of the body, and is exhaled in the form of carbonic dioxide (the "carbonic acid" of the old books on chemistry). Plants breathe this, fix the carbon in their own tissues, and restore the pure oxygen to the atmosphere again by exhalation. —ED.]

NATURAL SELECTION.

[1813]—I will try and make clear to "Hallyards" (with whose gratification *I* am gratified) my meaning by "the excess being cut off."

Huxley remarks, *in re* the crayfish, that, on the whole, their numbers keep about the same in any given locality. Now this is just what seems to be the normal rule and *status quo* everywhere. Here, *e.g.* (Isola di Capri), from year to year, we note much about the same apparent amount of life—*e.g.*, a good many butterflies, but not so very many; a good many lizards, but not so very many; a few snakes (black and ground-coloured), apparently neither more nor less every year, and so on, *ad infinitum*. Even with quails (which appear in May and September) the rule, on the whole, seems to hold good.

The suspicion occurs, then, that there is, in reality, *no* struggle for *existence*, but merely for excessive existence. The superfluity are cut off, but not the proper quantity. My lovely (not "lonely") philosopher, whom I formerly subpœnaed and produced in court ("flights of painted moths," &c.) again says: "Little and big, minnow and leviathan, are alike to the Soul—that" (he continues, with his sublime audacity) "equally shoves Judas and Jesus aside."

Darwin was struck by the formation or metamorphosis of species. What strikes me is, *How the lid is kept down*. From the oldest laid-bare rocks forms meet us and greet us which meet us and greet us now: not only the uninteresting slug-shell, but the faërie dragon-fly, with the inimitable tracery of the Divine Architect (not carving, moulding, from without; but creating, becoming, from within:—Nature). How the lid is kept down is what strikes me:—Thus far shalt thou go, and no farther! Everything in its place:—every note and dot, jot and tittle of the gigantic orchestra, from the hum of ephemeræ up to "the music of the spheres." What, too, can be more astounding—*e.g.*, than the co-appearance of "the still small voice," tiny marsupials with the unutterable Saurians and Pterosaurians!—dragons ("that tare each other in the slime") and sea-serpents, swamp-serpents, 100 ft. long!! Will the selectionarians derive the Saurians from the marsupials: or *vice versa*, or how? Let us grope our way out of the fog!

Mr. Fountain (why should any of us quarrel? we are all only battling for the truth in the dark) was very severe upon me for saying "Matter ever was and ever will be." I am glad to see that "F. W. H." is an equally guilty sinner with me in "cocksureness" about this extra-Euclidean problem. He says, "Since whatever is, was, and will be." Self-evidently! at least since Lavoisier. Matter cannot be annihilated, and could not have been created out of nothing. "Change," yes, change is *the* law; but not *mere* change, unsystematic, unmotived (*unleitmotived*) change. No! but the metamorphosis of law, of the omnipresence, self-justified, self-existent, self-wise, self-design.

Yes; embryology does demonstrate that life begins with simple protoplasm. That reflection has not escaped me; but I turn it about to fight in my ranks. It begins with protoplasm, but not with *one*, one and the same protoplasm. Simple, but immense distinction! Each individual protoplasm (speck of jelly I sometimes call it) hath its own potentialities, marvellous, magical! (Truth is stranger than fiction!) And, for aught I know, the beginning, as we call it, may have been from countless millions of protoplasms with infinitely diverse potentialities. This theory is on the carpet.

"A Welshman" concedes what I want—namely, that the worm did not "acquire" (that is the Selectionarian Shibboleth) its softness, &c. I do not believe it "acquired" even its length. This is a matter of growth. Mr. Proctor has well reminded us that there are worms at the Cape a yard and more in length, and here, by the way, we see that these monsters have not extinguished the little tiny worms—rootlets, as Jean Paul calls them, of the universe tree, up to its fruit of stars.

"A Welshman" bases himself upon what the French term the *monde ambiant*, organism *cum* surroundings. This, of course, I admit (look, *e.g.*, at the transplanted plant, which from hairless becomes hairy. Look at the Americans, moulded by the *ambiant*

to likeness to the Aborigines.) This, of course, *I* admit, I realise; but this, just this, is what Mr. Darwin controverted as *the* cause—*the* cause, he maintained (with a lucid temperance of genius, of labour and learning, which I should be the last not to extol *in excelsis*), *the* cause, he maintained, lay in natural selection: *id est*, the selection by circumstance of what *happened* to show themselves *per* variation the fittest in the struggle for existence.

This doctrine of Natural Selection, as the Cause of Evolution, is what I am disputing; it seems rather to me a Consequence—of Nature's Invention: thus, Nature invented the recurved hooks of seeds, &c., and these were selected by, or even did select, Opportunity (see Shakespeare's marvellous musical eloquence about Opportunity in "Lucrece").

Again, the very basis of the Darwinian superstructure is Heredity. But *who invented Heredity?* Was that, too, "acquired?" I trow not!

And he says (basis again) the offspring tends to "vary" in the same part as the parent; but if the parent, *e.g.*, has a large foot, the tendency of the offspring to have a still larger foot can scarcely be termed variation; if it varied it might vary *away* from the parent. Moreover all such "variation" has its limits. Peas, to cite the case mentioned by Dr. Ball, do not go on getting larger *ad infinitum*. We do not see giants twenty feet high, whales 1,000 feet long.

Darwin is the Luther of the nineteenth century. That is why we so greeted him. He has struck open *our* Bible. What men are hungering and thirsting after is Religion—not Dogma, but Truth; not Superstition, but Nature; not Priestcraft, but God; the proof of immortality, which is alone interesting—*our* God—we are slowly coming to perceive, is what is plus the soul of what is, or, in my favourite phraseology from the poet whom we have as much right to call divine as the Italians have to call Dante, "the cause, the cause, my soul!"

Now, after all, "Natural Selection," though exquisitely ingenious, and true to a certain extent, seems to me, for one, rather a shallow explanation of the Problem of the Universe (*e.g.*, I do not believe the giants in those days were extinguished by Natural Selection), and Evolution itself waits for much further illumination and development.

I should like to make, as it were, a *pronunciamiento* of the statement—for the reflection of "A Welshman" and others whom this superb subject may concern—that Mr. Darwin stakes his reputation on the doctrine of Natural Selection, and, forsooth, in this utmost form, namely, that the most subtle and gracious organs and contrivances, "insect's wing and eagle's eye,"* Mozart's ear and Shakespeare's brain are the result of Natural Selection—that is, of tiny beneficial, or victor variations, transmitted and cumulated in the course of incomputable ages.

Now I, for one, do not believe that the eye, *e.g.*, was so "acquired"; the exquisite nerves for appreciating "The dew-dropping south o'er a bank of violets"; all, all this fabric of nervous tissue, myriad inlets for the infinite.

Nor do I exactly credit that the many and great gaps in the living chain are due to extinction *per* Natural Selection (another Darwinian *leitmotiv*). For instance, how plausible would it be for a mere outsider, theoretical Adam, beholding the beasts defile before him, to argue, *ecco* the lion! surely monarch of all he surveys; *he* must exterminate all! But no. The lion, lord as he is, is not numerous, whereas his timid victims—gazelles and other creatures are—make up for their feebleness by fertility, and, also, their modes of escape. Behold the horse! he, too, a magnificent animal! his neck clothed with thunder; running a race with the wind! but, luckily, he does not eat flesh; he is an innocent herb-eater. The whale is Leviathan; but lo, he actually exists upon Infusoria! What a lesson! what a moral! and so on throughout. *The* principle Darwin leaves out of sight almost, namely, compensation, advantage *and* drawback.

ALEX. TEETGEN ("Commentator.")

EVOLUTION.

[1814]—"Commentator's" attack on Darwin's theory because it does not explain *how* variation happens seems to me about as reasonable as if he were to find fault with Newton because the latter did not attempt to show the means by which gravitation acts. Newton proved that a law which we call gravitation exists, but how that force operates he could not explain. Shall we therefore depreciate the value of Newton's labours? Surely not; and why should "Commentator" seek to minimise the value of Darwin's work? Darwin set himself to prove (1) that organisms vary; (2) that there is no reason to suppose that there is any limit to this variability; (3) that, variability being granted, it follows that some forms *must* be better adapted to their circumstances than others, and will therefore survive. This is really all that is involved in Darwin's great theory. He sought, not to show how an animal can produce young which are *not* identical in all respects with itself: he merely took the fact of variation as he found it, and showed that all the rest follows from it.

It is difficult to make out whether "Commentator" disbelieves *toto cælo* in variation, or believes that any given species can vary only within certain limits. If the former, he must surely disbelieve the evidence of his own senses. Can he find two human faces, for instance, that are precisely alike? If he believes in restricted variability, on what evidence does he base his belief? The fan-tail pigeon is the result of the selection of variations which took place in the common pigeon. But the fantail itself varies, some individuals being more divergent from the original stock than others. Is there any reason to suppose that the limit of variability has been reached?

But perhaps "Commentator" does not intend to dispute variability at all; but merely its spontaneity. If so, why does he quarrel with Darwin, who expressly refrained from theorising on a point as to which neither he nor anyone else could be possessed of any evidence? Whether variability is spontaneous (unscientific word!), the result of laws of which we have no conception, or the work of a Great Designer, makes no difference to the theory of evolution, for that theory only *begins* with the million-times-proved fact of variability. As well complain of the theory of light, because it does not explain the origin of the sun, as tilt against evolution because it doesn't make clear how the offspring of five-fingered parents sometimes have six digits on each hand.

CHAS. E. BELL.

VARIATION IN THE APPARENT MAGNITUDE OF SPECTRAL IMAGES.

[1815]—I have myself noticed the phenomenon of variation in the *apparent* magnitude of the *ocular spectra*, as the eye adapts itself to vision at longer or shorter distances, a phenomenon referred to in No. 192 (p. 12). I believe I have noticed the fact in some of my papers on "Light." I say variation in *apparent* magnitude, because there does not appear to be the slightest suggestion of a reason for a change in the *actual* magnitude of these spectra on the retina. The phenomenon was very noticeable after gazing at the coloured figures in that book, which was published some years since, for the purpose of illustrating the phenomena of the *ocular spectra*. The reasons for this *apparent* increase and decrease in the *spectra*, when the eye is adjusted for vision at shorter and longer distances, is this, that the spectral image persists on the retina of one constant magnitude, but this image being brought into juxtaposition with the diminished objects of a more distant field of vision appears *relatively* larger, and with the environment of the larger objects of a closer field of vision *relatively* smaller. Thus it is that the rule of perspective appears to be reversed. The important fact that the *ocular spectra* have no external existence whatever, does not as yet appear to be fully recognised.

W. CAVE THOMAS.

KING'S COLLEGE SCHOOL.

[1816]—Vol. VIII. of *K.* opens with a severe—all the more severe because not violent—attack on the masters of the above, from the pen of our excellent Conductor.

I claim to be heard as an expert in a double way. The Head-master and myself had a week-and-week rivalry, when we were fifteen, for the prize of the third form in our school. Stokoe was neither a bully nor a sneak, but an all-round good fellow, steady as he was genial. Our master died Head-master of Charterhouse; so he had a good model of what a master ought to be. I beat him in class-work, but he was superior in exercises, so had the prize. But we never had the least jealousy or meanness over our strife.

I hold Mr. Proctor absolutely wrong in his general canon that bad tone among boys lies at the masters' door. I know that schools change like society, and always—almost—from within. Those who make the tone of a school are the *leading boys*—and, as these are constantly changing, no *one can ever know* what a school is, save from the boys themselves. *E.g.* the very school I was at with Stokoe. The head-master had come into office nearly ten years before. I found myself laughed at for piety, persecuted for industry. By the time I had been there three years, all was changed! Piety rather the fashion, industry quite a *sine qud non*. An idle fellow was rather a cad. What was the cause? If it was in the masters, it could have been only through the advent (in my first half) of a big, sneering, affected under-master, who was said to have driven an Oxford coach for *money*. He, first of masters, joined in the games. I think it not impossible this may have done *something*.

* "The eye, that most pure spirit of sense."—Shakespeare.

But I know another school—all interns—of gentlemanly nice fellows, whose masters were ignorant, ill-bred muffs. One of the senior students told me that the moral state of the place was *excellent*; whereas, when he came, a youngster of eight, it was a sink of iniquity. Now, the change here was *certainly* not wrought by the masters. Morals are like epidemics. I have no doubt that in the cases cited by Mr. Proctor the change *did* emanate from the masters. But that must have been by accident. It is as in society. The standard of morals is always fixed by the laity—whatever they determine on doing, the clergy must sanction eventually, or else they would have no adherents. Of course, they ought to submit to that disaster; but then they don't.

I felt pained at the admission of Dr. Stokoe that he did not know of the bullying in question; but I feel sure there must have been some special cause for his ignorance. It seems a pity, anyhow, to increase, at this moment, the very deep concern he must feel. HALLYARDS.

"THE COMITY OF NATIONS."

[1817]—I always understood this to mean "that mutual urbanity which nations find it convenient to show toward each other" (from *cŏmis*, polite). But in April, 1871, a great lawyer made a great speech, in which he spoke several times of the "comity of nations" as synonymous with "*community* of nations." I turned up Johnson and others, but could find no trace of the word *comity* other than as above. The *Times* based a leader on the speech, and repeated several times the same phrase in the same sense, with capital letters. I wrote to the *Times* expostulating, but was not inserted.

Now, in the *Saturday Review* for May 30, p. 718, I find "Japan's policy aims at the adoption of the fruits of Western civilization, and the attainment of a status of recognised equality in the comity of nations." Here is the self-same error.

There might, of course, be a word *comity* = company, from *cŏmitatus*, whence comes our word *county*; but it would be most inconvenient to have two words of identical spelling, but diverse derivation and meaning; for then we might praise a judge and a riding-master, each for his *equity*—the one for *æquitas*, the other *equitatus*. HALLYARDS.

"PRINTERS' DEVILRY."

[1818]—That "Hallyards" is a most exceedingly learned man, I have no earthly doubt; but (letter 1811) he does not seem to be quite so well acquainted with the writings of "the Divine William" as he might be, or else he would have known that the *Saturday* was quoting from Mrs. Quickly, "Henry V.," act ii., scene 3:—"Nay, sure, he's not in hell; he's in Arthur's bosom, if ever man went to Arthur's bosom." G. SMALLPEICE.

GEORGE ELIOT.

[1819]—There is still a necessity, I think, for another word to be spoken in connection with George Eliot and her partner. The relationship has been too severely censured by "Commentator" and too much defended by Mr. Proctor. While sympathising with a great many observations ably expressed by the latter, I cannot help thinking that he has allowed his love and reverence for the writer to plead on behalf of what has always been considered reprehensible in Sand and Chopin. It is surely a healthy sentiment which demands from our teachers a higher morality than exists in the multitude. If there is virtue in our laws, surely it is right for one who could create for us an Adam Bede to make a sacrifice on their behalf. It is all very well to say that if Eliot and Lewes wronged no one personally, it was justifiable. In the first place, a wrong might occur to children. In the second place, the question, I think, is a far deeper one. Do such acts discredit the law, and is such an example a salutary one for society? While, no doubt, many things can be urged in defence of the happy fellowship of these celebrated people, surely a more heroic line would have been more in harmony with their teaching. GAMMA.

A LONG SPELL.

[1820]—In your "Gossip" in KNOWLEDGE you say, "It is a misfortune that few men of science will condescend to avoid the use of technical terms." This is the more to be regretted when technical terms assume the form of those in the following paragraph, which I extract from *Science Gossip* for July, p 162: "It appears that some supposed pentanitrodimethylaniline has been shown to be trinitromethylnitroniline. The substance in question has been obtained from napthyldimethamidophenylsulphone." G. H.

DIVERS REJOINDERS.

[1821]—*Condor* 40 ft. from tip to tip of wings.* I saw this about forty years ago, noted on the fly-leaf of a book, by my father, from (I think) Humboldt. It struck me so much that I have never forgotten it. I could wish it verified. It is not likely my father was wrong, as he had succeeded, before he was twenty-four, in having his name given to two places on the earth's surface; which, as "'ἀνδρῶν ἐπιφανῶν πᾶσα μὴ γάφος," is certainly the neatest way of appearing on the tombstone. (Could I live in libraries, I would make a dictionary of all men in like case, with brief notice. This would be a geographical peerage, and useful companion to every geography.)

Satellites. Jupiter and Saturn certainly have some larger than the moon in *apparent* diameter; but, as J. and S. are held to be not yet condensed, and to be *going to be* very much smaller than they are at present, is it not reasonable to suppose that their satellites are in a similar puffy state?† Now, the one thing certain about the moon is that she is solid, and final, at all events.

Infinite divisibility. I am unable to see why one should be able to halve everything, without getting to a point indivisible. If we could, then I might say that because I have a pound in my pocket, I shall always have *some* money, because, however small the balance, I can always halve it. (This is flippant, of course.)

HALLYARDS.

BENEDICITE!

[1822]—I am deeply pained to find from Mr. Proctor's note on p. 11 that I have (it seems) wasted valuable space on nonsense. The only exit seems to be "the Hundreds." "I guess I shall jine a church this fall," as Artemus Ward says (or, stay—perhaps it was some other A. W.—Archbishop Whatily, for instance.)

I was perfectly certain the two statements in question had been made by Mr. Proctor; I cannot tell where, nor does it matter, since (at any rate) they do not represent his opinion. But this defect of apprehension convinces me that it is not only my sight that is failing me, and that I am not much in the right place in discussing science.

I remember Mr. Proctor writing of me years ago "by no means a fool, but fitter to be taught than teach." I never tried to do that. I have ventured to put certain sceptical ideas on paper, supposing that the acting Editor would not print absolute bosh.

The fact that a scientific opinion is universally received in no way proves its truth. Mr. Proctor himself (am I mistaken here?) showed that all astronomers had been childishly wrong about resolvable nebulæ being galaxies; and that Sir G. Airy was also in error as to a transit of Venus. He also wrote a paper called "A Menacing Comet," which frightened numbers of people. He has since explained that no comet, in his opinion, is likely to do any harm. If that be so, what did it "menace"? In spite of my almost extravagant admiration for him, I could not help feeling that the *SaturdayReview* was on the side of reason about "the *Spectator's* comet."

As regards the reply to me on p. 14, I should be really obliged if the following emasculated (but is *that* admissible?) statement be allowed to appear. The Editor severely snubbed a correspondent who wrote about what the Editor calls "a savage rite," and said it did no good. I wrote, showing, not only that it was invented by the beginners of all civilisation, but that it is alleged to produce the most serious moral and physical benefit. My language was carefully chosen—*virginibus puerisque*—though it is absurd to regard any such restrictions in a scientific discussion—it is like fighting with one arm tied—and the Editor burkes my letter. Probably he does right; but it does seem to me hard on the correspondent who was originally snubbed, and to whom our good Editor now devotes sixteen lines of disquisition on the merits of the rite in question, which he allows no one to *defend*.‡

I am extremely obliged to Mr. Butler for his courteous note and sketch of a buff spider, but it is not the same species as mine, which I examined with a lens. The legs are longer, there are five

* "This day I shot a Condor. It measured from tip to tip of the wings eight and a half feet, and from beak to tail four feet."—*Darwin's Jounal of Researches*, p. 182.—ED.

† Certainly not.—ED.

‡ Peccavi. I was wrong originally in permitting the initiation of a discussion which (however suitable to the columns of the *Medical Press and Circular*) was wholly out of place here. Had I, in common parlance, "had my wits about me," I must have foreseen how practically certain such a question must be to drift into all sorts of collateral issues more or less unsavoury, and unsuitable to the ordinary student of science. I am bound to say that nothing advanced either by Mr. Collins or "Hallyards" himself has caused me, in the slightest degree, to modify my opinion.—ED.]

XUM

depressions instead of three, and the corners are much sharper. I have since (in the very same place) seen one that was buff with green markings, recalling a jockey.

In 1882 I addressed to K—— a long letter, showing that the chronology of Miss A. B. Edwards, in her "Pithom and Ramses" articles was totally impossible. This was not inserted, but sent to Miss E., who addressed to me in next no. a very courteous note. I then resolved to confine myself to enriching K. with auroras, zodiacal lights, and other meteors, which are to scientific what the humble "enormous gooseberry" is to general journalism; and I renew this resolution now. Should I ever be tempted to write mere opinions, or quotations, or arguments, I really think the kindest course for the editor to follow will be simply W.P.B. and silence—but a note *based upon* a burked letter is very apt to prejudice the correspondent. *Vaya con dios!* HALLYARDS.

P.S. At first I did not intend to comment on Mr. Proctor's notes; but it has occurred to me that it was inferred from the probable rectilinear motion of the *majority* of stars that there would be collisions; that these, though apparently accidents, might in reality be foreseen, and part of the provision of the cosmos. I incline to believe that this was in the papers on Sir W. Herschel's views as to the distribution of the stars, this year (to which I am unable to refer at present). If it was not there, it was certainly not an "outer barbarian" who wrote it, but one of the "inner circle"—of "the clever ones" (Mrs. Clennam & Co.)—of those who justly say "we are they that ought to speak—who is lord over us?"

If the above (about collisions) is pure imagination, how is it that I am aware that the following is indeed so?

A century ago Sir W. H. discerned that the sun is moving, very much slower than the earth in her orbit, towards a point in Hercules. There is, hitherto, no change in *direction* observed (though the no. of miles per second is declared?). Therefore, if the sun is moving in a curve, it is so vast that in a century it does not appreciably differ from a straight line. This does not show it to be one; but, so far, it may be supposed to be straight. Mr. Proctor (?) has shown that Mädler was quite mistaken in his "central sun" theory.

When I wrote "It will be replied," I had not the least idea of Mr. P.—so there is no creation of a "semi-idiotic second self."

"It will be replied that their rate of translation will overcome the pull of the nearest body—though any one who would reply thus would say anything." ("I think my friend Mr. —— of the —— club said he knew you."—"*There's fellers in that club would say anything*,"—replied the—(certainly not amiable)—character. I here cite from Thackeray.)

I am disconsolate to be found wrong about so simple a matter. I thought that in the case of one body revolving round another there are but two forces in question. The smaller may be conceived passing in a straight line; the pull of the larger is just sufficient to convert this motion into a curve; erroneously described formerly as centrifugal and centripetal force. That is what I meant. Put so much more "rate of translation" on the earth, and it would overcome the sun's pull, and she would go off in space in a straight line—saving accidents. The suspected companion of Venus is supposed to have got loose in some such way.

A correspondent pointed out the other day that Mr. P. had stated that space must be infinite. I refrained from saying that that in no way convinces me he has not said also the contrary. (Because it is a mere matter of speculation; a wise man's opinions are liable to change; and when a man writes a great deal he cannot possibly remember all he writes. "Commentator" complained lately that Mr. P. had contradicted himself flatly about the present habitability of the planets; I believe he did.) He tells me he *has* said "we cannot *conceive* infinite space,—a mightily different matter." Different, *concedo; mightily so, nego:* contrariwise, it is a long step towards my version. It is *still more inconceivable* that space should be finite. I believe the human mind will never be able to comprehend the real state of the question at all. It was created for its own special needs, and no higher. I can imagine a mind as far above it as Mr. P.'s is above my own. H.

A DREAM.

[1823]—I subjoin an extract from a letter, received on Monday last, from a son of mine who is in command of the fastest s.s. in the New Zealand waters, merely premising that the "poor N——" referred to was a younger brother of his who was washed overboard in mid-Atlantic, and the "poor P——" a quadroon, who returned with me from the West Indies in the eventful year 1848, and who nursed him and all his brothers and sisters, except the eldest, but died last January twelvemonth:—"Now, my dear father, I am going to tell you an astounding fact. On the date poor N—— was drowned I saw him struggling in the water on the port-side of a steamer in a stormy sea, when all at once he disappeared, and directly after, in my dream, I saw poor P—— sitting at the foot of my bed. She said, "Not you," and vanished. I woke up, went on deck, and told the chief-officer of it, and, on my return below, I made a note of it in an almanack. Since then I have worked it out, and it tallies to the *moment* of the sad occurrence" (I having given him, in a letter to which the above was his answer, the latitude and longitude, with local time of it). W. A.

MENTAL PHENOMENA.

[1824]—I was much struck the other day by a little French boy informing me that his grandfather's peacock was sometimes heard as far as Noirmentier (an island ten miles off). This, examined, turned out to be based on a reported fact that some one had heard it *on the sea*—*i.e.*, a few hundred yards away. But, on reflexion, I could not deny that the original statement was specious. Thus:—

The peacock is heard on the sea,—
Noirmentier is on the sea,—

Therefore the peacock is heard at Noirmentier.

Just after, I took up a printed letter of the Card. Abp. of Paris to the Pope. In the first two lines H. E. tells H. H. that he had recovered from a dangerous illness, "thanks, I think, to your H.'s blessing."

Now, was the Abp. more logical than the child? Does he hold that none ever recover without the Pope's blessing? If he does not, how does he connect cause and effect?

It is like Tenterden Steeple and the Goodwin Sands; and not altogether unlike some modern speculations on cause of man's survival.

I believe there will always be Christians: but it is surely time for churchmen to "report progress" on some points, and "tacitly recede from" (Card. Newman's phrase) prayers for fine weather, and against earthquakes, thunderstorms, and pestilences.

There is a collect (8th after Trinity)—which I never could read gravely. Who are "we," that we should get all profitable things (the orig. has "cuncta" *and* "omnia") and escape all hurtful things (of course to the detriment of some of our "dearly beloved brethren" elsewhere.) HALLYARDS.

MEAN-TIME SUN-DIALS.

[1825]—I propose having a mean-time sun-dial constructed, and shall be much obliged to "E. L. G." (with reference to his letter, No. 1724, page 465) if he will tell me how he derives his rule for the ordinates. It had seemed to me that if the radius of the hour circle were multiplied by the sine of half the equation of time, plus the quantity S (expressed as angle), we should have the true length of the ordinate, the axis of the gnomon passing through the centre of the circle; but I have no doubt that he is right.

In the expression for the abscissa, the factor $(1 - \sin^2 \overline{N + S})$ might, I think, be omitted, as (except in the case of very large dials) its effect on the length would be inappreciable.

Since writing the above I have seen E. L. G.'s letter, No. 1658, p. 290 (previously overlooked), which gives the explanation asked for. The factor $(1 - \sin^2 N + S)$ may certainly be omitted. In small dials it would make no difference, and in large ones the edge of the shadow is so vague that great accuracy is impossible.

MUSAFIR.

LETTERS RECEIVED AND SHORT ANSWERS.

JOS. HORNER. The reply which you enclose was written by the Conductor of KNOWLEDGE, and I had never even seen it before. Nor, so far as I am aware, was your MS. in existence when I took over the editorship about the end of last June. Hence the seeming inconsistency, which I can only sincerely regret.—AN ANONYMOUS CORRESPONDENT forwards a leaf cut from *The Bazaar* of July 3, containing grave charges against the promoters of the *Golden Argosy* scheme of prizes, and complaining that these prizes were advertised in KNOWLEDGE. I must reiterate that the appearance of an advertisement of any sort in the columns here devoted to them can and must in no sense whatever be held to imply any sort of editorial guarantee for its *bona fides*. Of course, an announcement *known* to emanate from a doubtful source would be refused insertion, but advertising belongs to the business department of the paper, with which the editor has nothing whatever to do.—J. WEBB asks Mr. Clodd for the name of the publisher of the re-issue of the "Biblia Pauperum"? With regard to your request for a Greek Lexicon, I myself always use the English edition of Schrevelius, in which the definitions are, as you require, framed on philological and not on merely doctrinal grounds.—W. invites "Coleford's" attention to the circumstance that, according to his

("Coleford's") theory, if Mr. and Mrs. Jones have four children, there must be four fathers and four mothers altogether!—E. G. S. I do not know of any dictionary devoted expressly to the explanation of scientific terms. A considerable proportion of them will be found in such books as Ogilvie's "Imperial Dictionary." I must add, though, that it is a rule that all contributors to KNOWLEDGE should explain every technical term they employ when it first occurs; and hence that readers of original articles in these columns should never need to refer to any extraneous source at all for the meaning of words which occur here.—J. W. ALEXANDER. I am sorry that I am unable to print your letter, but the "Mind and Matter" discussion has now dragged out to such a weary length, and has been so wholly barren of any fruitful result, that I am compelled to close it.—C. HILL. I do not insert your circular because I am firmly convinced that the opening of museums, &c., on Sunday would be a very great national boon. As for your idea that it would lead to Sunday labour, the Trade Unions will take exceedingly good care that it does not do that.—AN ANONYMOUS CORRESPONDENT sends me a *Birmingham Daily Mail*, containing an account (from the *Sheffield Star*) of the finding of a live toad in a block of coal! The "silly season" seems to have set in very early and with unusual severity in Sheffield this year.—WILLIAM MATTHEWS. So far I have only received your letter, the "accompanying communication" not having reached me.—COMMENTATOR. I do not reproduce M. Ramus's article because it is utterly unsound. The axis of the earth can never have been perpendicular to the plane of the ecliptic for dynamical reasons. Its variation is secular, and the extreme possible limits of it are 2° 37′ 22″. What does the fly-leaf on "Titles" mean? Thanks again for photograph.—ARNOLD REED. You can scarcely hope to pass well in honours in electricity without some knowledge of mathematics, that is if the examination is what it ought to be. Prof. Thompson's "Elementary Lessons in Electricity and Magnetism" will give you a good insight into the subject. It is, of its kind, the best in the market.

Our Parador Column.

[I print the subjoined letter from our old friend the author of the "P. D. Theory" as a specimen of close and sustained reasoning on a scientific subject! Perhaps some reader can explain what on earth it is all about. No one to be allowed more than three guesses.—ED.].

July 2nd 1885 Newcastle

EDITOR. DEAR SIR If the "Tit Bits" in KNOWLEDGE June 19th, 26th; came from Hallyards, Commentator, Gamma, A Welshman, F. W. H. and others,—If they would read their Book of Time, which is composed by the matter of thought and printed only on The mind of man,—They would surely have one and the same idea about "Darwinism or Protoplasm or the immanence of Life in matter," Mr R. A. Proctor says, men were once deceived with regard to time. They thought the duration of this earth represented all time—was, at least, central in time; But, they know it now as infinite time; What says the Book,—I am, no other substitute is capable of holding the same power's as I am the main-spring of life, and the duration of all existence. It seems to me bosh, to fancy that duration can be parted from existence, how can any-thing exist without time or how can time proceed without the motion of something existing. As there is no substitute for time, as it is composed of intervals of infinite variety, as it will have its own way so must things be so:—Time keeps the matter in motion continually by its exigence and granulating process, which forms the river's of life going out of one element into another, each element been refreshed and restored by receiving supplies of energies passed down from one element to another. This change of matter proceeds from the granulating process, were the heavy particle's displace the lighter particle's, caursing the formation of gravity to set in, as a momentum action between the centre point and the external points. Mr Proctor says, The actual process of restoration, which, to us, seems so simple a matter, could not possibly suggest itself to creatures having their limited knowledge and experience. That the air in which they lived contained the stores from which the river's, so unlike in all respects, was constantly nourished,—It could not occur to their minds at all:—If (tit bits) cannot follow "Darwin" through his little stream of life. How-ever will they be able to follow through the great sea's of time. time with its infinite season's will bring our earth to what it was once before, and what it was ten thousand times before that, it must return with its season, no change. Infinite time produces infinite season's, years don't count.—Yours, truly,

J. MURRAY.

Our Whist Column.

BY "FIVE OF CLUBS."

DECLINE AND FALL OF WHIST.

UNDER this title, Pembridge, author of the lively treatise, "Whist or Bumblepuppy," has published a jeremiad—an old-fashioned view, as he calls it, of new-fangled play. He rejects the developments of modern whist as tending to the injury and eventually to the destruction of the fine old game. There is so much truth in what he says, though it is not all truth, that I take pleasure in helping to make as widely known as possible his protest against the mischievous tendencies of some of the modern teachings.

OBJECTIONS TO "THE PETER."

Pembridge first attacks the signal for trumps. And truly when one considers how the signal is too often used, one cannot wonder (I beg and entreat the compositors not here to substitute the offensive "he" for my "one")—one cannot wonder, I say, if a strong player should be disposed to rail against the abuse of a signal which, properly used, is very valuable. The signal ought to be an imperative call for trumps; but nine times out of ten it is an unwise proclamation of trump strength. To such a pitch has foolish signalling passed, that for my own part, I decline to respond to the signal until I have become satisfied by a sufficient amount of play, that my partner knows when he ought to signal and when he ought to refrain. Pole's perfectly preposterous rule that you should always signal from five trumps,—a rule which he gives as *general* for all except strong players!—and the absurd misinterpretation of Clay's correct rule, have done more to make weak players mischievous than perhaps any thing since the modern conventions were first started. Clay's rule, which ought to act as a corrective of Pole's later absurdity, is used by many to intensify the mischief. Says Clay, correctly, you should make it a rule never to signal from less than five trumps one honour, or from four trumps two honours. The tyro adopts instead as his rule, always signal from five trumps one honour, and from four trumps two honours. Yet Clay was careful to say, in so many words, that he would by no means recommend signalling from a hand containing the specified strength in trumps. (I note here in passing that in America, Clay's negative rule, even, would not be sound; for in American Whist honours are not counted, and thus the conditions for signalling are entirely altered. When in England and Europe generally, for instance, you hold four trumps two honours, the odds are in favour of your holding, with partner, two by honours, in which case only three tricks are required—supposing the score at "love"—to win; and again, with five trumps one honour, you know that the odds are in favour of honours being either "easy" or in your favour. It should, indeed, be always remembered by Americans, in reading English books on Whist, and especially on "Short Whist," that American Whist and English Whist are different games.)

But "Pembridge" would not be justified in his opposition to the signal if the following conditions for signalling were always obeyed:—A player should only signal for trumps when, holding at least five trumps, or four headed by Ace, King, by Ace, Queen, by King, Queen, or by Queen, Knave, Ten, he has (or sees that his partner has) both length and strength in one suit, and protection in the enemy's suits, while the state of the score requires that a long suit should be established and brought in to win the game.

If there is any rule at Whist which should be regarded as absolutely general perhaps the following is one:—NEVER *signal when you want only the odd trick to win or save the game.*

It is a good rule to pay no attention to the signal unless given by a player who knows what he is doing when he signals. You will often expose yourself to the angry comments of "duffers" by declining to respond to their signals, when by accident it has chanced that they had really justification for "petering." But you must play in accordance with the chances, and it is certain that when your partner is a duffer he will signal at least five times for each single occasion when he ought to have signalled; consequently you do much more harm by responding to all his signals than by paying no attention to them, beyond regarding them as signifying a certain amount of trump strength in his hand. For, apart from the circumstance that you will only fail to answer a justified signal once in five times, there is, after all, much less harm in omitting to lead trumps when you should, than in leading trumps when you should not. It is only very seldom that omitting to lead trumps when you should has serious bad effects; but it is absolutely disastrous to lead trumps when by so doing you are playing your adversaries' game.

(To be continued.)

XUM

Our Chess Column.

BY MEPHISTO.

ILLUSTRATIVE GAME No. 1.

A COMPETING partie in the competition of the B. C. A. for the most brilliant game played in that tournament :—

RUY LOPEZ.

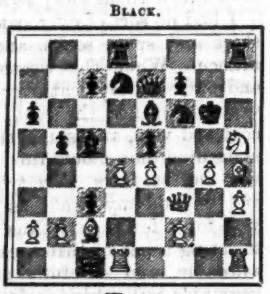
White.	Black.
1. P to K4	P to K4
2. Kt to KB3	Kt to QB3
3. B to Kt5	P to QR3
4. B to R4	Kt to B3
5. P to Q3	B to B4 (*a*)
6. P to B3	P to QKt4 (*b*)
7. B to B2	P to Q4
8. Q to K2	Castles
9. B to Kt5 (*c*)	B to K3
10. Kt to Q2	P to R3
11. B to R4	Q to K2
12. P to KR3	QR to Qsq. (*d*)
13. P to KKt4 (*e*)	P to KKt4 (*f*)
14. Kt × P (*g*)	P × Kt

BLACK.

WHITE.

15. B × P	P to Q5 (*h*)
16. Kt to B sq. (*i*)	K to Kt2
17. Q to B3	Kt to Kt sq.
18. Kt to Kt3	QKt to Q2
19. Castles QR (*j*)	R to KR sq.
20. Kt to R5 (ch)	K to Kt3 (*k*)
21. B to R4	P × P (*l*)
22. P to Q4 (*m*)	P × P (ch)

BLACK.



WHITE.

23. K to Kt sq.	B × QP
24. R × B	Q to B4 (*n*)
25. R to Q5	Q to K2
26. R × Kt (*o*)	R × R
27. B × Kt	Q to B4
28. B × R	B × P (ch)
29. K × B	P to Kt8(Q) (ch)
30. K × Q	Q to Kt5 (ch)
31. B to Kt3	Resigns

NOTES.

(*a*) At this point the doctors differ as to whether it is best to play 5. B to B4 or 5. P to Q3. We imagine that a disinclination to adopt a defence leading to dull and heavy play causes players to revert to 5. B to B4. The objections against 5. B to B4, however, are, in our opinion, of considerable weight. White may play B to K3. If Black exchanges Bishop's, White's centre will be strengthened. Black cannot conveniently retire his B, as in the Giuoco Piano, to Kt3, in consequence of having played P to QR3. If B to R2, White exchanges, placing Black's Rook very awkwardly. Again, White may reply with 6. P to QB3, as in the text; then by playing P to Q4 at an opportune moment, he may derive a benefit in position, while the White B is available on B2, to support the centre advance, and may ultimately become a very commanding piece by attacking the KRP. To avoid this unmasking, Black is prevented from playing P to Q4 after he has Castled. In fact, in most cases it is dangerous for Black to Castle too early, as White may get up a strong attack against Black's K's side. These are the principal objections against 5. B to B4, and, as will be seen from the game (which occurred in the Tournament of the B. C. A.), nearly all of them are exemplified here by a corresponding inferiority in Black's position.

(*b*) Necessary, in order to play P to Q4. If P to Q3, Black would have an inconvenient position, owing to his QKt being pinned, and the probability of the advance of the White QP, an inconvenience which a player ought to avoid if he can do so; at the same time, P to QKt4 brings White's B into better play.

(*c*) Of course general principles must always be subordinate to the opponents' tactics, as otherwise a player will win in spite of bad development. 9. B to Kt5 is the right move here, for if 9. B to K3, B × B, the P cannot retake, as Black could double White's P's by P × P. It may be seen here that the Black KB would be far better placed on K2.

(*d*) Here the principle as regards pinning is amply illustrated. By placing his R on Q sq. Black doubly pins his own Kt, and thereby creates another weak point in his position.

(*e*) This move is valuable as an instance of a deviation from a general rule in a particular case. The general rule being that it is advantageous to secure one's own position by Castling before proceeding to the attack, but, as stated in note *c*, circumstances alter cases. In this instance it would be somewhat inconvenient to Castle QR (it being clearly part of White's plan and to his advantage to attack Black's King's side) on account of several harassing moves which are at Black's disposal, such as P to Kt5, P to Q5, &c. Moreover, by the text move White obtains an immediate advantage in position.

(*f*) Black could not otherwise prevent White from playing P to Kt5.

(*g*) This sacrifice is possible, on account of the position of Black's Q and R, and the general aspect of the game. Similar opportunities occur in many variations of the Giuoco Piano. A thorough examination of the position is, however, required in most cases, to see whether the piece may safely be given up. Thus, for instance, if the square on Black's K3 were unoccupied, it would enable Black to play Q to K3, followed by B to K2.

(*h*) Black wanted to prevent the advance of the White QP.

(*i*) The QKt does good service on the K's side.

(*j*) White's attack being now far better developed, he may Castle more effectively and with greater security.

(*k*) Although Black would have still had a bad game, he would have done better to take the Kt with the R. In that case White would have proceeded to double the Rooks on the Kt's file.

(*l*) This brings about a speedy loss, but Black had no satisfactory move at his disposal.

(*m*) Better late than never; White seizes the opportunity which brings his B to bear on the attack.

(*n*) If P × R, then 25. P to K5 discovering check would be fatal.

(*o*) White now simply breaks up Black's game.

We have given the above game, as promised, as the first of a series of real games, in which we endeavour to explain the principles which ought to guide players in the conduct of games. We shall, however, be pleased to enter into any discussion or give further explanation upon any point in these games which appears doubtful to our readers.

Mr. R. A. Proctor's Lecture Tour.

Subjects:

1. LIFE OF WORLDS
2. THE SUN
3. THE MOON
4. THE PLANETS
5. COMETS AND METEORS
6. THE STAR DEPTHS

Each Lecture is profusely illustrated.

Arrangements are now being made for the delivery of Lectures by Mr. Proctor from August onwards. Communications respecting terms and vacant dates should be addressed to the Manager of the Tour, Mr. JOHN STUART, Royal Concert Hall, St. Leonards-on-Sea.

Aug. 11 and 12, Worthing. Aug. 13 and 14, Eastbourne. Aug. 17, 19, and 24, Tunbridge Wells. Aug. 25 and 26, Folkestone.

September.—Buxton, Matlock, Bath, York, Scarborough, Whitby, Ilkley, &c. (Particulars next week.)

Nov. 4, Burnley. Nov. 17, Darwen.

Feb. 18 and 25 (1886), London Institution.

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